Series 1961, No. 27
Issued August 1965

Soil Survey
HOCKLEY COUNTY
Texas

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
In cooperation with
TEXAS AGRICULTURAL EXPERIMENT STATION

HOW TO USE THE SOIL SURVEY REPORT

THIS SOIL SURVEY of Hockley County will serve several groups of readers. It will help farmers and ranchers in planning the kind of management that will protect their soils and provide good yields; assist engineers in selecting sites for roads, buildings, ponds, and other structures; serve as a reference for students and teachers; and add to our knowledge of soil science.

Locating the Soils

Use the index to map sheets at the back of this report to locate areas on the large map. The index is a small map of the county that is numbered to show where each sheet of the large map is located. When the correct sheet of the large map has been found, it will be seen that boundaries of the soils are outlined, and that there is a symbol for each kind of soil. All areas marked with the same symbol are the same kind of soil, wherever they occur on the map. The symbol is inside the area if there is enough room; otherwise, it is outside the area and a pointer shows where the symbol belongs.

Suppose, for example, an area located on the map has the symbol (AfA). The legend for the detailed map shows that this symbol identifies Amarillo fine sandy loam, 0 to 1 percent slopes. This soil and all others mapped in the county are described in the section "Descriptions of the Soils."

Finding Information

Different parts of the soil survey will be of particular interest to different groups of readers.

Farmers and ranchers can learn about the soils in the section "Descriptions of the Soils" and then turn to the section "Use and Management of Soils." In this way, they first identify the soils on their farms or ranches and then learn how these soils can be managed and what yields can be expected. In the section "Use and Management of Soils," the soils are placed in capability units, which are groups of soils that need similar management and respond in about the same way. For example, Amarillo fine sandy loam, 0 to 1 percent slopes, is in capability unit IIIe-4, dryland, if it is not irrigated and in IIe-4 if irrigated. The management necessary for this soil will be discussed under those capability units.

The soils are also grouped in range sites, which are kinds of rangeland. Each range site has its own potential for production of grasses and other vegetation. For example, Amarillo fine sandy loam, 0 to 1 percent slopes, is in the Mixed Land range site. A description of each range site is given in the subsection "Range Management."

The "Guide to Mapping Units, Capability Units, and Range Sites" at the back of the report will simplify the use of the map and the report. The guide lists the name and map symbol for each soil and the page on which the soil is described. It also lists the capability units and range sites in which the soil has been placed and the pages on which these are described.

Engineers can refer to the subsection "Engineering Uses of Soils." Tables in this subsection show characteristics of the soils that affect engineering.

Soil scientists and others will find information about how the soils were formed and how they are classified in the section "Genesis, Classification, and Morphology of Soils."

Students, teachers, and others will find information about the soils and their management in various parts of the report, depending on their particular interest. Some readers will be especially interested in the section "General Soil Map," where broad patterns of soils are described. Others will be interested in the section "General Nature of the County," which describes the climate and geology of the county, and gives some statistics about the agriculture, transportation, and markets.

* * * *

This cooperative soil survey was made by the Soil Conservation Service and the Texas Agricultural Experiment Station. Fieldwork was completed in 1961, and unless otherwise stated, all statements refer to conditions at that time. This soil survey is part of the technical assistance furnished to the Hockley County Soil Conservation District.

Cover picture: Irrigated farm in Amarillo fine sandy loam soil association near Levelland.

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Issued August 1965

SOIL SURVEY OF HOCKLEY COUNTY, TEXAS

BY DARRELL G. GRICE, WILTON GREEN, AND WAYNE RICHARDSON, SOIL CONSERVATION SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, IN COOPERATION WITH THE TEXAS AGRICULTURAL EXPERIMENT STATION

HOCKLEY COUNTY is in the southern part of the High Plains in the western part of Texas (fig. 1). Levelland, the largest town and the county seat, is about 30 miles west of Lubbock, Texas. The county is nearly square—about 29 miles wide from east to west and about 31 miles from north to south. It has an area of 577,920 acres.

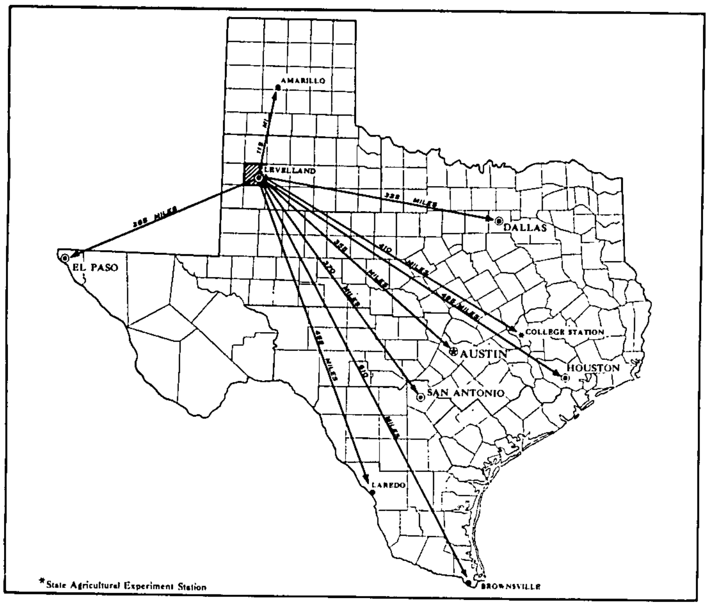

Figure 1.—**Location of Hockley County in Texas.**

The topography of the county is that of a nearly level plain with a general slope to the southeast. The elevation above sea level ranges from 3,450 to 3,600 feet.

Hockley County is mostly agricultural. About 447,000 acres are cropland, of which about 189,000 acres are irrigated. Cotton and grain sorghum are the main crops. Other crops grown are small grain, soybeans, alfalfa, and vegetables. About 110,000 acres are in native range.

The climate of the county is semiarid. In some years moisture is ample, and yields of crops may be above average; in other years there are periods of drought and crops are below average, except on irrigated land. Most precipitation falls in the spring and late summer. The average annual rainfall is about 17.5 inches. Temperature varies widely.

All of the soils are subject to wind or water erosion if they are cultivated, and they all have some natural limitations. Soils must be used according to their capabilities if they are to produce their best yields without being damaged. This report describes the soils, points out their susceptibility to erosion or other hazards, tells what crops or other uses are best suited to them, and suggests management to maintain the soils.

The farmers and ranchers in the county organized the Hockley County Soil Conservation District in 1947. The district helps farmers and ranchers get technical assistance from the Soil Conservation Service of the U.S. Department of Agriculture or from the Texas Agricultural Experiment Station.

How Soils Are Mapped and Classified

Soil scientists made this survey to learn what kinds of soils are in Hockley County, where they are located, and how they can be used.

They went into the county knowing that they would likely find many soils they had already seen, and perhaps some they had not. As they traveled over the county, they observed steepness, length, and shape of slopes; size and speed of streams; kinds of native plants or crops; kinds of rock; and many facts about the soils. They dug or bored many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down to the parent material that has not been changed much by leaching or by roots of plants.

Soil scientists made comparisons among the profiles they studied and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide uniform procedures. To use this report efficiently, it is necessary to know the kinds of groupings most used in a local soil classification.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Amarillo and Olton, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in natural characteristics.

Many soil series contain soils that differ in texture of their surface layer. According to such differences in texture, separations called soil types are made. Within a series, all the soils having a surface layer of the same texture belong to one soil type. Amarillo fine sandy loam

and Amarillo loam are two soil types in the Amarillo series. The difference in texture of their surface layers is apparent from their names.

Some soil types vary so much in slope, degree of erosion, number and size of stones, or some other feature affecting their use, that suggestions about their management could not be made if they were shown on the soil map as one unit. Such soil types are divided into phases. The name of a soil phase indicates a feature that affects management. For example, Amarillo fine sandy loam, 0 to 1 percent slopes, is one phase of Amarillo fine sandy loam, a soil type that ranges from nearly level to gently sloping.

After a fairly detailed guide for classifying and naming the soils had been worked out, the soil scientists drew boundaries of individual soils on aerial photographs. These photographs show buildings, field borders, trees, and similar details that greatly help in drawing boundaries accurately. The soil map at the back of this report was prepared from aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning management of farms and fields, a mapping unit is nearly equivalent to a soil type or a phase of a soil type. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of other soils that have been seen within an area that is dominantly of a recognized soil type or phase.

In preparing some detailed maps, the soil scientists have a problem of delineating areas where different kinds of soils are so intricately mixed, and so small in size, that it is not practical to show them separately on the map. Therefore, they show this mixture of soils as one mapping unit and call it a soil complex. Ordinarily, a soil complex is named for the major soil series in it, for example, Berthoud-Mansker loams.

Occasionally, two or more soils that are not geographically associated are shown as one mapping unit because they are so nearly alike in slope, stoniness, or some other dominant characteristic that mapping them separately would add little information to the soil survey. Such a mapping unit is called an undifferentiated group. The mapping unit, Spur and Bippus soils, is an example. An undifferentiated group of soils differs from a complex in that all the soil series in the group may not occur in each mapping area.

While a soil survey is in progress, data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soils. Yields under defined management are predicted for all the soils. Samples of soils are taken as needed for laboratory measurements and for engineering tests, and laboratory data on the same kinds of soils in other places are assembled.

But only part of a soil survey is done when the soils have been named, described, and delineated on the map, and the yield and laboratory data have been assembled. The mass of detailed information then needs to be organized in a way that is readily useful to different groups of readers, among them farmers, ranchers, engineers, and homeowners. Grouping soils that are similar in suitability for each specified use is the method of organization commonly used in the soil survey reports. Based on the yield and practice tables and other data, the soil scientists set up trial groups of soils and test them by further study and by consultation with farmers, agronomists, engineers, and others. Then, the scientists adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under present methods of use and management.

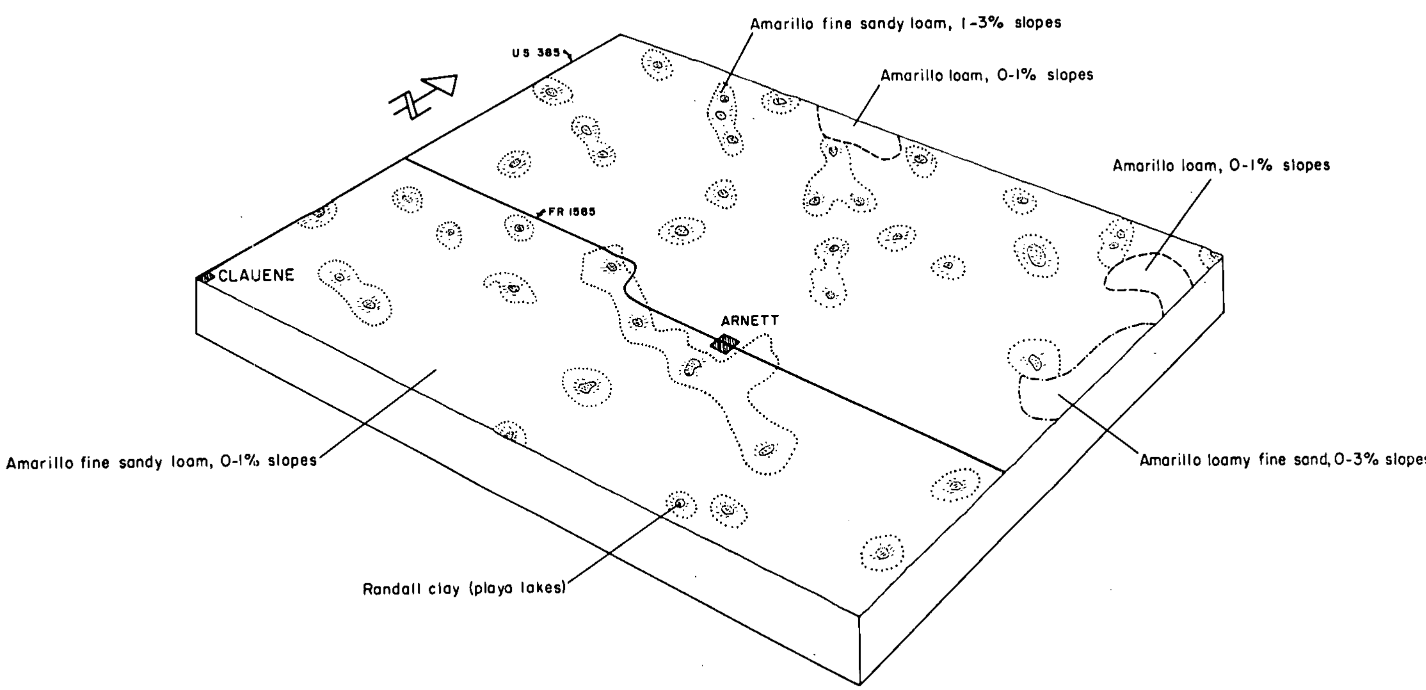

Figure 2.—**Amarillo fine sandy loam soil association, dotted with many playa lakes, covers an area 52 square miles southeast of Levelland.**

General Soil Map

After study of the soils in a locality and the way they are arranged, it is possible to make a general map that shows several main patterns of soils, called soil associations. Such a map is the colored general soil map in the back of this report. Each association, as a rule, contains a few major soils and several minor soils, in a pattern that is characteristic although not strictly uniform.

The soils within any one association are likely to differ in some or in many properties; for example, slope, depth, stoniness, or natural drainage. Thus, the general soil map shows, not the kind of soil at any particular place, but several distinct patterns of soils. Each pattern, furthermore, contains several kinds of soils.

Each soil association is named for the major soil series in it, but, as already noted, soils of other series may also be present. The major soils of one soil association may also be present in other associations, but in a different pattern.

The general soil map is useful to people who want a general idea of the soils, who want to compare different parts of a county, or who want to know the possible location of good-sized areas suitable for a certain kind of farming or other land use.

The five soil associations of Hockley County are described in the following paragraphs.

1. Amarillo fine sandy loam association: Deep, nearly level to gently sloping sandy loams

This soil association, the largest in the county, is a broad, nearly level to gently sloping plain. It makes up approximately 65 percent of the county, and most of it is in the central and western parts.

The dominant soil is the deep, productive, nearly level to gently sloping Amarillo fine sandy loam, which is dotted by hundreds of shallow depressions. These depressions, which contain intermittent lakes, provide the only drainage system (fig. 2). Randall, Zita, Portales, Mansker, and Drake soils are in the depressions and on the eastern side (fig. 3). Amarillo fine sandy loam generally occupies the gentle slopes on the western side of the depressions. Between Sulphur Draw and Lost Draw in this association are small areas of Portales soils.

About 90 percent of this soil association is cultivated, mainly to cotton and grain sorghum. About 45 percent is irrigated by wells that yield 200 to 800 gallons per minute.

Rangeland in this soil association supports a mixture of blue grama and buffalograss and some side-oats grama. Most of the rangeland, however, has been invaded by mesquite brush.

The soils of this association are productive but must be protected from wind erosion.

2. Amarillo loamy fine sand association: Deep, nearly level to gently sloping sandy soils

This soil association, one of the smallest in the county, has a total area of about 30,000 acres. It occurs in eight separate areas on the plain in the western and north-central parts of the county.

Amarillo loamy fine sand, the principal soil of this association, is deep and sandy. It occurs in large, nearly level to gently sloping or undulating areas marked by a few intermittent lakes. These depressions, or playa lakes, are noticeably fewer than in the rest of the county. In some places Amarillo fine sandy loam occurs with Amarillo loamy fine sand. Tivoli and Brownfield soils occupy a small area of this soil association in the north-central part of the county and about 700 acres in the southwestern corner. The Tivoli is a deep, loose sand, and the Brownfield is a deep soil that has a thicker, sandier surface layer than the Amarillo soils.

About 75 percent of this association is cultivated, and approximately 20 percent of this is irrigated by sprinklers. Cotton and grain sorghum are the main crops. The 25 percent of this association not cultivated is rangeland,

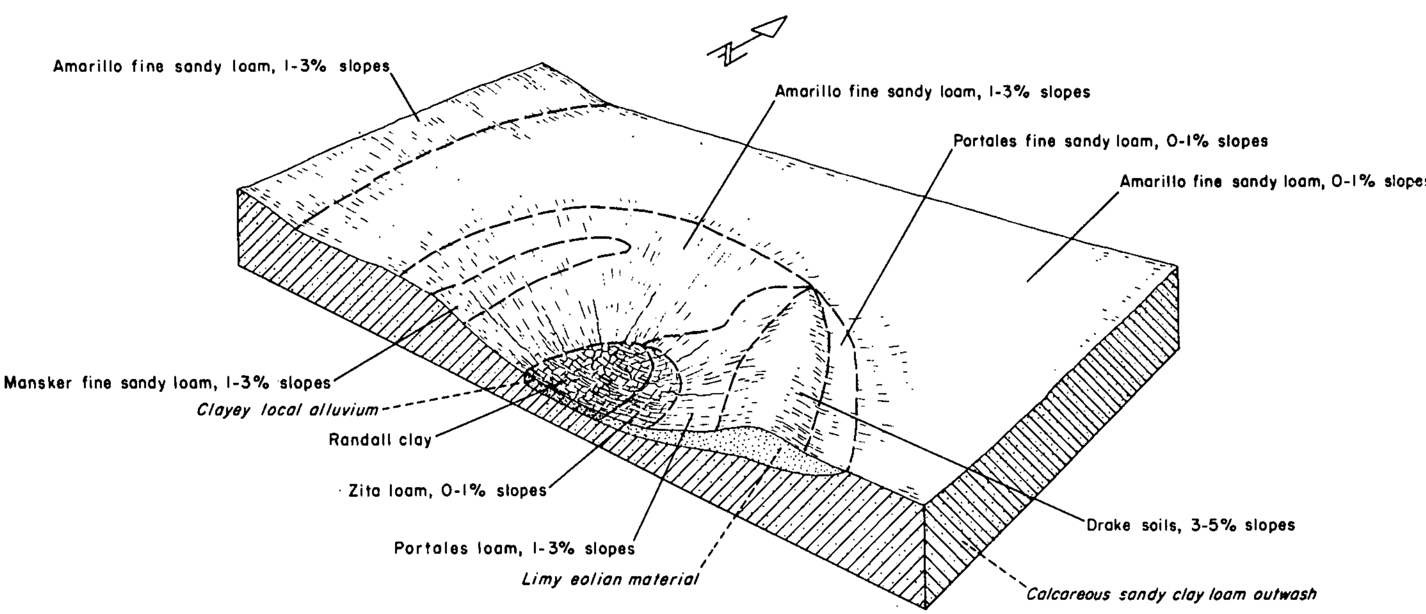

Figure 3.—**Playa lake and associated soils.**

which could support a fair stand of side-oats grama, little bluestem, and other tall grasses. Most of this range is in poor condition, however, and the plant cover includes much shin oak, three-awn, and sand dropseed.

These sandy soils are moderately productive, but intensive practices and careful use are required to protect them from wind erosion and to maintain a vigorous growth of grasses.

3. Amarillo-Arvana fine sandy loams association: Deep and shallow, nearly level to gently sloping fine sandy loams

This soil association is in the northwestern part of the county. Like the Amarillo fine sandy loam association, it is on a plain dotted by many depressions that contain intermittent lakes. At its eastern edge, short, steep ravines and escarpments have been carved by water draining into and toward Yellow Lake. The total area of this soil association is about 28,000 acres.

The dominant soil is Amarillo fine sandy loam, a deep, productive, reddish-brown soil that occupies many areas on the nearly level plain and on the gently sloping sides of the depressions. Arvana fine sandy loam is in similar positions and, in many places, is intermingled with the Amarillo soil in an irregular pattern. The Arvana soil is moderately deep and reddish brown; it is underlain by hard caliche. Arvana fine sandy loam, shallow, is common in the eastern third of the association and in small areas elsewhere. It is reddish brown and is underlain by hard caliche.

Other soils in this association are the Kimbrough, which are very shallow, brown soils underlain by hard caliche. The Kimbrough soils are common in narrow areas above the ravines and escarpments in the eastern part of the soil association. Also in the eastern part are the Mansker soils, which are shallow, and the Potter soils, which are very shallow and are underlain by soft caliche. Randall, Zita, and Portales soils occur in the depressions and on the eastern side of the depressions.

About 55 percent of this association is cultivated, mainly to cotton and grain sorghum. Lack of water limits the irrigated area to 5 percent or less of the cultivated acreage. The deep and moderately deep cultivated soils in the association are productive but must be protected from wind and water erosion.

Rangeland, which makes up 45 percent of this association, supports a mixture of blue grama and buffalograss and some side-oats grama. Most of the rangeland is in the eastern part of the association, where shallow soils are common. Because the shallow soils have low capacity to store water, the rangeland must be managed carefully to maintain the better grasses and to prevent invasion by undesirable plants.

4. Amarillo-Olton loams association: Deep, mainly nearly level hardlands

This soil association is the second largest in the county and occupies a large tract in the eastern part. It is on a broad plain marked by many depressions and makes up about 20 percent of the county.

About 60 percent of this association consists of deep, permeable Amarillo loam. Most of the remaining 40 percent is deep Olton loam, which has a compact subsoil, but areas of Mansker, Portales, Zita, and Drake soils are common in the depressions. The soils of this association are, for the most part, nearly level. Gently sloping areas are fewer than in the other soil associations.

About 90 percent of this association is cultivated, and 60 percent of the cultivated acreage is irrigated. In the northern and southern parts of the association, the supply of irrigation water is good, but in the central part the wells are few and low yielding.

Cotton and grain sorghum are the main crops, but small grains, forage sorghum, and vegetables are also grown. The rangeland supports a good growth of blue grama and buffalograss. Invading brush is not so much a problem on these finer textured soils as on the coarser textured soils of the other soil associations.

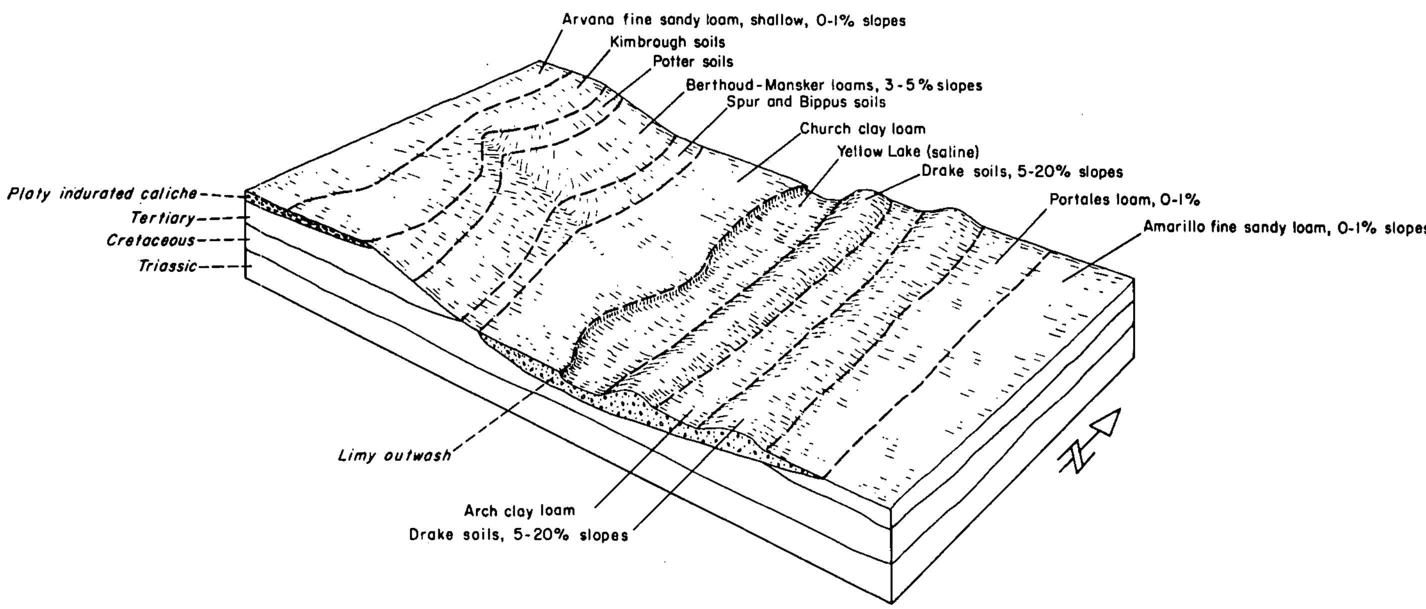

Figure 4.—Saline lake, associated soils, and surrounding topography in Portales-Arch soil association.

These soils are fertile and productive if irrigated, but they are droughty if dry farmed.

5. Portales-Arch association: Nearly level to gently sloping limy soils

This soil association occupies less than 20,000 acres in the north-central part of the county near Yellow Lake. Most of it is nearly level to gently sloping. Its western boundary, however, is occupied by Potter soils, on a steep escarpment and by areas of moderately sloping Berthoud soils. Along the eastern boundary there are areas of sloping Drake soils (fig. 4).

Portales soils, which are dominant in this association, are calcareous and moderately deep. The Arch soils, which are shallow, gray, limy soils, occur with the Portales soils, as do also the deep, limy Drake soils in duned positions, and the Church soil, which is limy and has a compact subsoil.

About half of this association is cultivated, and the rest is rangeland. Shallow, low-yielding wells supply irrigation water for only a few acres. Cotton and grain sorghum are the main crops.

Parts of this soil association have a high water table, and the water has a rather high content of salt. Cultivated areas could be harmed in the future, as continued evaporation of water would tend to increase the concentration of salt in the root zone of plants.

These soils are poorly suited to cultivation because they are highly susceptible to wind erosion and have low fertility. The rangeland supports blue grama, buffalograss, alkali sacaton, and side-oats grama.

Descriptions of the Soils

In this section the soil series are described. Each series description is followed by brief descriptions of the individual soils, or mapping units. These are the areas bounded by lines and identified by symbols on the detailed soil map. Shown in parentheses at the end of each soil description are the capability unit and range site in which the soil has been placed.

Detailed, technical descriptions of the soil profiles are not given in this section, but a profile representative of each series is described in the section "Genesis, Classification, and Morphology of Soils." Some of the terms used in describing the soils are defined in the Glossary. The "Guide to Mapping Units, Capability Units, and Range Sites" at the back of the report lists the pages on which the soils, capability units, and range sites are described. The approximate acreage and proportionate extent of the soils are given in table 1.

TABLE 1.--APPROXIMATE ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Soil	Area	Extent
	Acres	Percent
Amarillo fine sandy loam, 0 to 1 percent slopes	208,590	36.1
Amarillo fine sandy loam, 1 to 3 percent slopes	75,820	13.1
Amarillo fine sandy loam, 3 to 5 percent slopes	470	.1
Amarillo loam, 0 to 1 percent slopes	96,230	16.6
Amarillo loam, 1 to 3 percent slopes	6,440	1.1
Amarillo loamy fine sand, 0 to 3 percent slopes	35,560	6.1
Arch clay loam	2,940	.5
Arch fine sandy loam	1,540	.3
Arvana fine sandy loam, 0 to 1 percent slopes	5,590	1.0
Arvana fine sandy loam, 1 to 3 percent slopes	950	.2
Arvana fine sandy loam, shallow, 0 to 1 percent slopes	1,630	.3
Arvana fine sandy loam, shallow, 1 to 3 percent slopes	760	.1
Berthoud-Mansker loams, 3 to 5 percent slopes	3,230	.6
Bippus clay loam, 1 to 3 percent slopes	540	.1
Brownfield fine sand, thick surface	700	.1
Church clay loam	2,140	.4
Drake soils, 1 to 3 percent slopes	3,820	.7
Drake soils, 3 to 5 percent slopes	3,340	.6
Drake soils, 5 to 20 percent slopes	920	.2
Kimbrough soils	2,860	.5
Mansker fine sandy loam, 0 to 1 percent slopes	1,090	.2
Mansker fine sandy loam, 1 to 3 percent slopes	2,460	.4
Mansker loam, 0 to 1 percent slopes	870	.2
Mansker loam, 1 to 3 percent slopes	850	.1
Olton loam, 0 to 1 percent slopes	21,100	3.7
Portales fine sandy loam, 0 to 1 percent slopes	17,990	3.1
Portales fine sandy loam, 1 to 3 percent slopes	23,400	4.0
Portales loam, 0 to 1 percent slopes	15,960	2.8
Portales loam, 1 to 3 percent slopes	11,000	1.9
Potter soils	1,380	.2
Randall clay	9,110	1.6
Randall fine sandy loam	800	.1
Spur and Bippus soils	2,040	.4
Stegall-Lea loams, shallow	680	.1
Tivoli fine sand	280	(1/)
Zita fine sandy loam, 0 to 1 percent slopes	7,150	1.2
Zita loam, 0 to 1 percent slopes	7,690	1.3
Total	577,920	100.0

1/ Less than 0.05 percent.

Amarillo Series

The Amarillo series consists of deep, moderately sandy, reddish-brown soils that are nearly level to gently sloping. These soils occur throughout the county.

The surface layer of Amarillo soils is granular and reddish brown to dark brown. It ranges from loam to fine sandy loam to loamy fine sand in texture. This layer is generally about 10 inches thick but ranges from 6 to 14 inches in thickness.

The subsoil, about 44 inches thick, is sandy clay loam of weak, very coarse, prismatic structure. The upper 16 inches is reddish brown. The lower 28 inches is yellowish red and weakly calcareous in the last few inches.

The upper substratum, underlying the subsoil, is a layer of pink sandy clay loam in which calcium carbonate has accumulated. The depth to this layer ranges from 30 to 56 inches.

The lower substratum is pink or reddish-yellow, calcareous sandy clay loam.

The Amarillo soils are well drained. They have medium internal drainage and are moderately permeable. They have good water-holding capacity and high natural fertility but are susceptible to wind and water erosion.

The Amarillo soils have a more sandy subsoil than the Olton, are redder and less limy than the Portales, have a thinner and less sandy surface layer than the Brownfield, and are deeper than the similar Arvana soils.

Amarillo soils are well suited to cotton and grain sorghum; they are also suited to blue grama, buffalograss, side-oats grama, and other native grasses. Irrigation of these soils is common and successful.

Amarillo fine sandy loam, 0 to 1 percent slopes (AfA).—This soil is mainly in the central and western parts of the county. The surface layer, in most areas, is reddish-brown fine sandy loam about 10 inches thick (fig. 5). In some cultivated areas, however, part of the clay and silt in the plow layer has been blown away, and the upper 3 to 6 inches of soil is coarser than it was before cultivation.

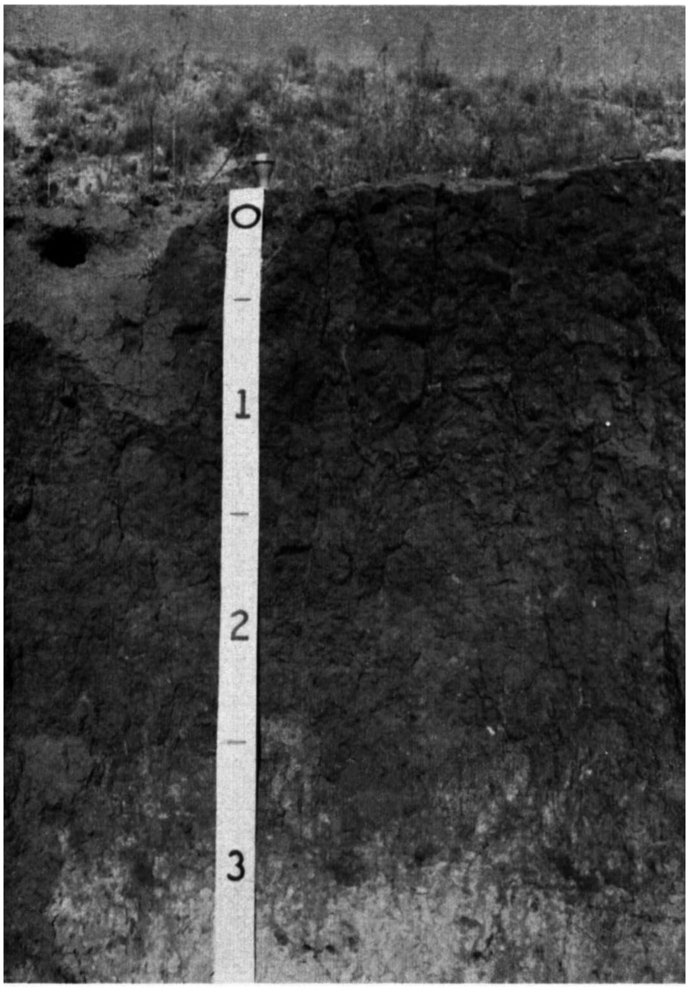

Figure 5.—**Profile of Amarillo fine sandy loam.**

Included with this soil in mapping are small areas of Portales fine sandy loam, Arvana fine sandy loam, Olton loam, and Zita fine sandy loam, all with slopes of 0 to 1 percent, and small areas of Amarillo fine sandy loam, 1 to 3 percent slopes. (Capability unit IIIe–4, dryland; capability unit IIe–4, irrigated; Mixed Land range site)

Amarillo fine sandy loam, 1 to 3 percent slopes (AfB).—This soil occurs mainly in the central and western parts of the county. It has a surface layer of reddish-brown fine sandy loam about 8 inches thick. In some cultivated areas, however, part of the clay and silt in the plow layer has been blown away, and coarser soil has been left in the upper 3 to 5 inches. Also, there are small areas where 3 to 5 inches of the surface layer has been removed by water erosion and deposited at lower positions.

The subsoil is about 32 inches thick. The upper substratum occurs at a depth of about 40 inches.

Included with this soil in mapping are small areas of Portales fine sandy loam, Arvana fine sandy loam, and Mansker fine sandy loam, all on slopes of 1 to 3 percent, and Amarillo fine sandy loam on slopes of 0 to 1 percent and 3 to 5 percent. (Capability unit IIIe–4, dryland; capability unit IIIe–5, irrigated; Mixed Land range site)

Amarillo fine sandy loam, 3 to 5 percent slopes (AfC).—This soil is mainly in the central and western parts of the county. It has a surface layer of reddish-brown fine sandy loam about 6 inches thick. In some areas, however, water erosion has removed 3 to 4 inches of the surface layer and deposited the material on lower slopes.

The subsoil is about 24 inches thick, and the pink, upper substratum is at a depth of about 30 inches.

Included with this soil in mapping are small areas of Mansker fine sandy loam, 3 to 5 percent slopes, and Amarillo fine sandy loam, 1 to 3 percent slopes. (Capability unit IVe–4, dryland; capability unit IVe–2 irrigated; Mixed Land range site)

Amarillo loam, 0 to 1 percent slopes (AlA).—This soil occurs mainly in the eastern part of the county. The surface layer is dark-brown loam about 11 inches thick. In some cultivated areas, part of the clay and silt in the plow layer has been blown away, and coarser soil has been left in the upper 3 to 6 inches.

The subsoil is about 29 inches thick, and the underlying substratum occurs at a depth of about 40 inches.

Included with this soil in mapping are small areas of Portales loam, Mansker loam, Olton loam, and Amarillo fine sandy loam, all with slopes of 0 to 1 percent, and small areas of Amarillo loam, 1 to 3 percent slopes. (Capability unit IIIce–2, dryland; capability unit IIe–2, irrigated; Deep Hardland range site)

Amarillo loam, 1 to 3 percent slopes (AlB).—This soil is in the eastern part of the county. It has a surface layer of brown loam about 8 inches thick. In some areas part of the clay and silt in the plow layer has been blown away, and here the upper 3 to 5 inches of this layer is coarser than it was before cultivation. Also in some small areas, 3 or 4 inches of the surface layer has been removed by water erosion and deposited at lower positions.

The subsoil is about 25 inches thick, and the upper substratum occurs at a depth of about 33 inches.

Included with this soil in mapping are small amounts of Amarillo fine sandy loam, Portales loam, and Mansker loam, all with slopes of 1 to 3 percent, and small areas of Amarillo loam, 0 to 1 percent slopes. (Capability unit IIIe–2, dryland; capability unit IIIe–3, irrigated; Deep Hardland range site)

Amarillo loamy fine sand, 0 to 3 percent slopes (AmB).—This soil is in the north-central and southwestern parts of the county. The surface layer is reddish-brown loamy fine sand about 12 inches thick. In some areas part of the clay and silt in the plow layer has been blown away.

The subsoil is about 44 inches thick. The depth to the upper substratum averages 56 inches.

Included with this soil in mapping are small areas of Amarillo fine sandy loam, 0 to 1 percent slopes, and Portales fine sandy loam, 0 to 1 percent slopes. (Capability unit IVe–7, dryland; capability unit IIIe–8, irrigated; Sandy Land range site)

Arch Series

The Arch series consists of moderately deep, limy, gray, nearly level soils in the north-central and northwestern parts of the county.

The surface layer of these soils is gray, granular, calcareous clay loam to fine sandy loam. It is generally about 8 inches thick but ranges from 6 to 12 inches in thickness.

The subsoil, about 11 inches thick, is light-gray clay loam of weak, coarse prismatic structure. It is strongly calcareous.

Underlying the subsoil, at a depth of about 19 inches, is the upper substratum, which is white clay loam that contains accumulations of lime.

The lower substratum is gray, limy clay loam.

The Arch soils are normally well drained, but one area southwest of Yellow Lake has a high water table. These soils are highly susceptible to wind erosion and slightly susceptible to water erosion. They have a moderate water-holding capacity and low natural fertility.

The Arch soils are less deep and more limy than the Portales, are more nearly level than the Drake, and have a sandier, more permeable subsoil than the Church soils. They are grayer and less deep than the Amarillo soils.

Arch soils are poorly suited to dryland cultivation. They are moderately well suited to irrigation but generally are not irrigated. Blue grama, side-oats grama, alkali sacaton, and other native grasses are suited to these soils.

Arch fine sandy loam (An).—This soil occurs only in a small area in the north-central part of the county. The surface layer is gray fine sandy loam about 6 inches thick. In some cultivated areas, part of the clay and silt in the plow layer has been blown away, and coarser soil has been left in the upper 3 to 5 inches.

The subsoil is about 10 inches thick, and the depth to the white upper substratum is about 16 inches.

Included with this soil in mapping are small areas of Mansker fine sandy loam, Portales loam, and Portales fine sandy loam, all with slopes of 0 to 1 percent, and small areas of Arch clay loam and Church clay loam. (Capability unit IVes–1, dryland; capability unit IIIes–1, irrigated; High Lime range site)

Arch clay loam (Ar).—This soil occurs mainly in the northwestern and north-central parts of the county, but it is also in a few small, scattered areas throughout the rest of the county. The surface layer is gray clay loam about 8 inches thick. In some cultivated areas, part of the clay and silt in the plow layer has been blown away, and coarser soil has been left in the upper 3 to 5 inches.

Included with this soil in mapping are small areas of Portales loam, Portales fine sandy loam, and Mansker loam, all with slopes of 0 to 1 percent, and small areas of Church clay loam and Arch fine sandy loam. (Capability unit IVes–1, dryland; capability unit IIIes–1, irrigated; High Lime range site)

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Arvana Series

The Arvana series consists of moderately deep soils and shallow soils, all underlain by hard caliche. These moderately sandy soils are dark brown and nearly level to gently sloping. They occur in the northwestern part of the county.

The surface layer is dark-brown, granular fine sandy loam. This layer is generally about 8 inches thick, but it ranges from 6 to 12 inches in thickness.

The subsoil is sandy clay loam of very coarse prismatic structure. This layer is about 22 inches thick. It is reddish brown in the upper 12 inches, yellowish red in the lower 10 inches, and weakly calcareous in the lowest part.

A hard, white caliche layer occurs at a depth of 10 to 36 inches, but generally at 30 inches.

The Arvana soils are well drained. Their internal drainage is medium, and they are moderately permeable. They have moderate water-holding capacity and moderate natural fertility and are susceptible to wind and water erosion.

Arvana soils are shallower than the Amarillo soils and redder than the Mansker and Portales soils. They differ also from those soils in being underlain by hard caliche.

Cotton and grain sorghum are well suited to the Arvana soils. Blue grama, buffalograss, side-oats grama, and other native grasses are also suited. The soils are suitable for irrigation, but the supply of water is not sufficient.

Arvana fine sandy loam, 0 to 1 percent slopes (AvA).—This soil occurs in the northwestern part of the county. The surface layer is dark-brown fine sandy loam about 8 inches thick. In some areas that have been cultivated, part of the clay and silt in the plow layer has been blown away, and the sandier soil has been left in the upper 3 to 5 inches.

Included with this soil in mapping are small amounts of Amarillo fine sandy loam, Portales fine sandy loam, Arvana fine sandy loam, shallow, and Mansker fine sandy loam, all with slopes of 0 to 1 percent, and small areas of Arvana fine sandy loam, 1 to 3 percent slopes. (Capability unit IIIe–4, dryland; capability unit IIe–4, irrigated; Mixed Land range site)

Arvana fine sandy loam, 1 to 3 percent slopes (AvB).—This soil occurs in the northwestern part of the county. The surface layer is reddish-brown fine sandy loam about 7 inches thick. In some areas that have been cultivated, part of the clay and silt in the plow layer has been blown away, and the sandier soil has been left in the upper 3 to 5 inches. There are also small areas where water erosion has thinned the surface layer and deposited the soil at lower positions.

The subsoil is about 17 inches thick, and the hard caliche occurs at a depth of about 24 inches.

Included with this soil in mapping are small areas of Arvana fine sandy loam, shallow, Amarillo fine sandy loam, Mansker fine sandy loam, and Portales fine sandy loam, all with slopes of 1 to 3 percent. (Capability unit IIIe–4, dryland; capability unit IIIe–5, irrigated; Mixed Land range site)

Arvana fine sandy loam, shallow, 0 to 1 percent slopes (AxA).—This shallow soil occurs in the northwestern part of the county, generally in rather small areas intermingled with larger areas of the deeper Arvana soils. The surface layer is reddish-brown fine sandy loam about 6 inches

thick. In a few areas that have been cultivated, part of the clay and silt in the plow layer has been blown away, and coarser soil has been left in the upper 3 to 5 inches.

The subsoil is about 13 inches thick, and the hard caliche occurs at a depth of 19 inches.

Included with this soil in mapping are small areas of Arvana fine sandy loam, Amarillo fine sandy loam, Portales fine sandy loam, and Mansker fine sandy loam, all with slopes of 0 to 1 percent, and small areas of Kimbrough soils. (Capability unit IVe–10, dryland; capability unit IIIe–10, irrigated; Mixed Land range site)

Arvana fine sandy loam, shallow, 1 to 3 percent slopes (AxB).—This soil occurs in the northwestern part of the county. The surface layer is reddish-brown fine sandy loam about 6 inches thick. In some cultivated areas, part of the clay and silt in the plow layer has been blown away, and the plow layer is coarser than it was before cultivation. There are also small areas where water erosion has thinned the surface layer and deposited the soil at lower positions.

The subsoil is about 10 inches thick, and the hard caliche occurs at a depth of about 16 inches.

Included with this soil in mapping are small areas of Arvana fine sandy loam, Amarillo fine sandy loam, and Mansker fine sandy loam, all with slopes of 1 to 3 percent, and small areas of Kimbrough soils. (Capability unit IVe–10, dryland; capability unit IIIe–10, irrigated; Mixed Land range site)

Berthoud Series

The Berthoud series consists of moderately deep, moderately sloping, calcareous, grayish-brown soils. These soils occur in the north-central part of the county along small drainageways.

The surface layer is granular, grayish-brown loam, generally about 9 inches thick, but it ranges from 6 to 12 inches in thickness.

The subsoil is sandy clay loam of weak, coarse, prismatic structure. This layer is about 11 inches thick and is calcareous and brown.

The substratum is very strongly calcareous, pale-brown sandy clay loam. It occurs at a depth of about 20 inches.

Berthoud soils are well drained. Their internal drainage is good, and their permeability is moderately rapid. They have moderate natural fertility and water-holding capacity. These soils are susceptible to wind and water erosion.

The Berthoud soils are more sloping than the Portales, deeper than the Mansker, and much deeper than the Kimbrough and Potter. They have a lighter colored surface layer than the Bippus soils and are more sloping. In Hockley County the Berthoud soils are mapped only in a complex with the Mansker soils.

Berthoud soils are poorly suited to cultivation. Only a few acres are farmed, and they are not irrigated. Blue grama, side-oats grama, and other native grasses grow well on these soils in rangeland or permanent pasture.

Berthoud-Mansker loams, 3 to 5 percent slopes (BlC).—These soils are in the north-central part of the county along some of the small drainageways. The Berthoud soil is so closely associated with the shallower Mansker soil that mapping them separately is impractical. Mansker loam makes up 30 to 40 percent of this complex.

The surface layer of Berthoud loam is grayish-brown and about 9 inches thick, and that of Mansker loam is dark brown and about 8 inches thick. In most cultivated areas, water erosion has removed a few inches of the surface layer and deposited it at lower positions.

Included with these soils in mapping are small areas of Bippus clay loam, 1 to 3 percent slopes, and small areas of Potter soils and Kimbrough soils. (Capability unit IVe–1, dryland; capability unit IVe–2, irrigated; Mixed Plains range site)

Bippus Series

The Bippus series consists of deep, dark-brown, gently sloping to nearly level soils in the north-central part of the county.

These soils have a surface layer of granular, dark-brown clay loam, that generally is about 22 inches thick, but ranges from 14 to 28 inches in thickness.

The subsoil is calcareous, pale-brown clay loam of moderate, granular structure. It is about 24 inches thick.

The substratum occurs at a depth of about 46 inches. It is pinkish-gray, very strongly calcareous, friable clay loam.

The Bippus soils are well drained. Their internal drainage is good, and they are moderately permeable. They have moderate water-holding capacity and moderate natural fertility. These soils are susceptible to wind and water erosion.

The Bippus soils are darker and less sloping than Berthoud, more sloping than the Spur, and darker and deeper than the Mansker and Portales soils. Some areas of the Bippus soils occur as bottom land in small drainageways. In Hockley County these areas are mapped in an undifferentiated unit with the Spur soils.

Bippus soils are moderately well suited to cultivation, but at present only a few acres are farmed, and they are in grain sorghum. They are not irrigated, but with good management, they could be irrigated successfully. Blue grama, buffalograss, side-oats grama, vine-mesquite, and other native grasses grow well on these soils in rangeland or permanent pasture.

Bippus clay loam, 1 to 3 percent slopes (BnB).—This soil is only in the north-central part of the county. The surface layer is dark-brown clay loam about 22 inches thick.

Included with this soil in mapping are small areas of Berthoud-Mansker loams, 3 to 5 percent slopes, and Mansker loam, 1 to 3 percent slopes. (Capability unit IIIe–2, dryland; capability unit IIIe–2, irrigated; Deep Hardland range site)

Brownfield Series

The Brownfield series consists of deep, sandy, brown, gently undulating soils. These soils are in the north-central and extreme southwestern parts of the county.

The Brownfield soils have a surface layer of brown or pale-brown loose fine sand about 22 inches thick.

The subsoil is reddish-brown sandy clay loam that is about 15 inches thick and has weak, coarse, prismatic and subangular blocky structure.

The substratum, which occurs at a depth of about 37 inches, may be pink sandy clay loam or yellowish-red fine sandy loam. The latter is most common in the southwestern part of the county.

These soils are well drained. Their internal drainage is medium, and they are moderately permeable. Their water-holding capacity is low in the surface layer and moderate in the subsoil, and their natural fertility is low. They are highly susceptible to wind erosion.

The Brownfield soils have a thicker, sandier surface layer than the Amarillo soils and a more clayey subsoil than the Tivoli soils.

Brownfield soils are not suited to dryland farming and are poorly suited to cultivation if irrigated. They are not irrigated in this county. Big bluestem, little bluestem, side-oats grama, and other native grasses are suited to these soils.

Brownfield fine sand, thick surface (0 to 3 percent slopes) (Br).—This soil is in the north-central and extreme southwestern parts of the county. The surface layer is brown or pale-brown fine sand about 22 inches thick.

Included with this soil in mapping are small areas of Amarillo loamy fine sand, 0 to 3 percent slopes, and Tivoli fine sand. (Capability unit VIe–6, dryland; capability unit IVe–5, irrigated; Deep Sand range site)

Church Series

The Church series consists of shallow, compact, limy soils that are grayish brown and nearly level to gently sloping. The largest area of Church soils is around Yellow Lake in the northwestern part of the county, but small areas also occur in the eastern part.

These soils have a surface layer of firm, calcareous, grayish-brown clay loam about 6 inches thick.

The subsoil is about 12 inches thick and is strongly calcareous, light brownish-gray clay loam of blocky structure.

Underlying the subsoil at a depth of about 18 inches is the upper substratum, which is a firm, strongly calcareous, light-gray clay in which calcium carbonate has accumulated. The lower substratum occurs at about 30 inches and is firm, gray, strongly calcareous clay.

These soils are moderately well drained. Their internal drainage is medium, and they are slowly permeable. They have high water-holding capacity and low natural fertility. These soils are highly susceptible to wind erosion and moderately susceptible to water erosion.

Church soils have a more compact, clayey subsoil than the Arch or Drake soils. They are grayer and shallower than the Portales soils and are slightly higher and better drained than the Randall soils.

Church soils are poorly suited to cultivation. Some small areas in the eastern part of the county are used for grain sorghum or small grain. These soils generally are not irrigated. They produce a good growth of buffalograss, alkali sacaton, and other native grasses.

Church clay loam (0 to 3 percent slopes) (Ch).—This soil occurs in the eastern and the extreme north-central parts of the county.

Included with this soil in mapping are small amounts of Arch clay loam, Portales loam, 0 to 1 percent slopes, and Drake soils, 1 to 3 percent slopes. (Capability unit IVes–1, dryland; capability unit IIIes–1, irrigated; High Lime range site)

Drake Series

The Drake series consists of limy, grayish-brown, gently sloping to sloping soils in small areas throughout the county.

The surface layer of these soils is granular, calcareous, and grayish brown. It ranges from fine sandy loam to loam to clay loam in texture.

The subsoil is strongly calcareous, light brownish-gray clay loam of very coarse prismatic structure. It is about 7 inches thick.

The substratum is at a depth of about 15 inches. It is strongly calcareous, porous, light gray, and several feet thick.

The Drake soils are well drained. Their internal drainage is good, and their permeability is moderately rapid. They have moderate water-holding capacity and low natural fertility and are highly susceptible to wind and water erosion.

These soils are more sloping than Arch or Church soils and are shallower and more limy than Portales soils. They are grayer, shallower, and more sloping than Zita soils.

The gently sloping Drake soils are poorly suited to cultivation. Grain sorghum is the common crop in cultivated areas, but it is often affected by iron chlorosis, which reduces yields. Irrigation is not common. The moderately sloping and sloping Drake soils are not suitable for cultivation. Blue grama, black grama, and alkali sacaton grow well on Drake soils in native range or permanent pasture.

Drake soils, 1 to 3 percent slopes (DrB).—Areas of this soil are scattered throughout the county. The surface layer generally is grayish-brown clay loam or fine sandy loam about 10 inches thick. In some cultivated areas, however, part of the clay and silt in the plow layer has been blown away, and coarser soil has been left in the upper 3 to 5 inches. In some areas, especially in cultivated fields, water erosion has thinned the plow layer and deposited soil at lower positions.

The subsoil is about 10 inches thick. The substratum occurs at a depth of about 30 inches.

Included with this soil in mapping are small areas of Portales loam, Portales fine sandy loam, Mansker loam, and Mansker fine sandy loam, all with slopes of 1 to 3 percent, and small areas of Drake soils, 3 to 5 percent slopes. (Capability unit IVes–1, dryland; capability unit IIIes–1, irrigated; High Lime range site)

Drake soils, 3 to 5 percent slopes (DrC).—These soils are in small areas near intermittent lakes throughout the county. They have a surface layer of grayish-brown clay loam, loam, or fine sandy loam about 8 inches thick. In a few cultivated areas, some of the clay and silt has been blown away, and the plow layer is somewhat coarser than when it was plowed from sod. Water erosion has also thinned the plow layer and deposited the soil at lower positions.

Included with this soil in this mapping are small areas of Portales fine sandy loam, 1 to 3 percent slopes, and Drake soils, 1 to 3 percent slopes. (Capability unit VIe–3, dryland; capability unit IVe–4, irrigated; High Lime range site)

Drake soils, 5 to 20 percent slopes (DrD).—The soils in this mapping unit occur only near the saline lakes in

the north-central and northwestern parts of the county. Their surface layer is grayish-brown loam or clay loam about 6 inches thick. The subsoil generally is 4 to 6 inches thick, but in places the surface layer directly overlies the substratum. The substratum is at a depth of 10 to 12 inches.

Small areas of Drake soils, 3 to 5 percent slopes, are included with this soil in mapping.

The soils of this mapping unit are entirely unsuitable for cultivation. (Capability unit VIe-3, dryland; High Lime range site)

Kimbrough Series

The soils of the Kimbrough series are very shallow, dark grayish brown, and nearly level to gently sloping. These soils are underlain by hard caliche and are in the northern part of the county.

The surface layer is granular in structure and ranges from loam to fine sandy loam in texture. It is dark grayish brown and about 7 inches thick. Directly underlying this layer is the white, hard caliche substratum.

The Kimbrough soils are well drained. Their internal drainage is medium, and they are moderately permeable. These soils have low water-holding capacity and moderate natural fertility, and their use is extremely limited by the hard caliche so near the surface. They are susceptible to wind and water erosion.

The Kimbrough soils are browner and shallower than the Arvana soils. They are shallower than the Mansker soils and have a hard, rather than a soft, caliche. Kimbrough soils are less sloping than the Potter soils and, unlike those soils, they have a hard caliche.

Kimbrough soils are entirely unsuitable for cultivation. Blue grama, buffalograss, and other native grasses grow well on areas in range.

Kimbrough soils (0 to 3 percent slopes) (Km).—These soils are in the northern part of the county. (Capability unit VIIs-1, dryland; Shallow Land range site)

Lea Series

This series consists of shallow, nearly level, dark grayish-brown, calcareous soils underlain by indurated caliche. They are only in the northwestern part of the county.

The surface layer is 6 inches of dark grayish-brown, granular loam.

The subsoil is clay loam that has subangular blocky structure. It is grayish brown in the upper 6 inches and brown in the lower 5 inches.

Underlying the subsoil at a depth of about 17 inches is a white, hard, caliche substratum.

The Lea soils are well drained. Their internal drainage is medium, and they are moderately permeable. They have moderate water-holding capacity and moderate natural fertility, but their production is limited by the hard substratum so near the surface. They are moderately susceptible to wind and water erosion.

The Lea soils are shallower than the Portales and Amarillo, have a harder substratum than the Mansker, and are deeper than the Kimbrough soils. They have a less compact, clayey subsoil than the Stegall soils. The Lea and Stegall soils have a substratum of white, hard caliche at about the same depth. These soils are so intermingled that they are mapped as a complex. This complex is described following the Stegall series.

Lea soils are poorly suited to cultivation and are not irrigated. Buffalograss, blue grama, and other native grasses grow well on these soils.

Mansker Series

The Mansker series consists of moderately shallow, brown, nearly level to moderately sloping soils in small areas throughout the county.

These soils have a surface layer that is brown loam to fine sandy loam in texture and granular in structure. This layer is calcareous. It generally is about 8 inches thick but ranges from 5 to 11 inches.

The subsoil is brown, calcareous sandy clay loam, about 5 inches thick. It has coarse, prismatic structure.

The upper substratum is strongly calcareous, very pale brown sandy clay loam in which calcium carbonate has accumulated. It occurs at a depth of about 17 inches. The lower substratum is at a depth of about 30 inches and is pink, strongly calcareous sandy clay loam several feet thick.

Mansker soils are well drained. Their internal drainage is medium, and their permeability is moderately rapid. These soils have moderate water-holding capacity and low natural fertility. They are susceptible to wind and water erosion.

The Mansker soils are browner and shallower than the Amarillo and Olton soils, are shallower than the Portales and Berthoud soils, and are deeper than the Potter and Kimbrough soils.

These soils are poorly suited to dryland farming. They are moderately well suited to irrigation, and this practice is common. Grain sorghum is the main crop. Side-oats grama, buffalograss, and other native grasses grow well on Mansker soils.

Mansker fine sandy loam, 0 to 1 percent slopes (MfA).—This soil is in the central and western parts of the county. The surface layer is brown fine sandy loam about 8 inches thick. In some cultivated areas, part of the clay and silt in the plow layer has been blown away, and the upper 3 to 5 inches is coarser than it was before cultivation.

The subsoil is about 10 inches thick, and the upper substratum occurs at a depth of about 18 inches.

Included with this soil in mapping are small areas of Mansker fine sandy loam, 1 to 3 percent slopes, and small areas of Amarillo fine sandy loam, Portales fine sandy loam, and Olton loam, all with slopes of 0 to 1 percent. (Capability unit IVe-10, dryland; capability unit IIIe-10, irrigated; Mixed Plains range site)

Mansker fine sandy loam, 1 to 3 percent slopes (MfB).—This soil is in the central and western parts of the county. The surface layer is brown fine sandy loam about 8 inches thick. In some cultivated areas, part of the clay and silt in the plow layer has been blown away, and the upper 3 to 6 inches is coarser than it was before cultivation. There are also small areas where the surface layer has been thinned 3 or 4 inches by water erosion, and the soil has been deposited at lower positions.

Included with this soil in mapping are small areas of Portales fine sandy loam, 1 to 3 percent slopes, Amarillo fine sandy loam, 1 to 3 percent slopes, and Mansker fine

sandy loam, 0 to 1 percent slopes. (Capability unit IVe–10, dryland; capability unit IIIe–10, irrigated; Mixed Plains range site)

Mansker loam, 0 to 1 percent slopes (MkA).—This soil is in the eastern part of the county. The surface layer is dark-brown loam about 8 inches thick, and the subsoil, also about 8 inches thick, is brown clay loam. The upper substratum occurs at a depth of 16 inches. A profile of Mansker loam is shown in figure 6.

Included with this soil in mapping are small areas of Portales loam, Amarillo loam, and Olton loam, all with slopes of 0 to 1 percent, and small areas of Mansker loam, 1 to 3 percent slopes. (Capability unit IVe–9, dryland; capability unit IIIe–10, irrigated; Mixed Plains range site)

Mansker loam, 1 to 3 percent slopes (MkB).—This soil is in the northern part of the county. The surface layer is calcareous, brown loam about 7 inches thick. In some small areas the surface layer has been thinned by water erosion and deposited at lower positions.

The subsoil is brown or light-brown, calcareous clay loam about 8 inches thick.

The upper substratum of strongly calcareous, pink clay loam occurs at a depth of 15 inches.

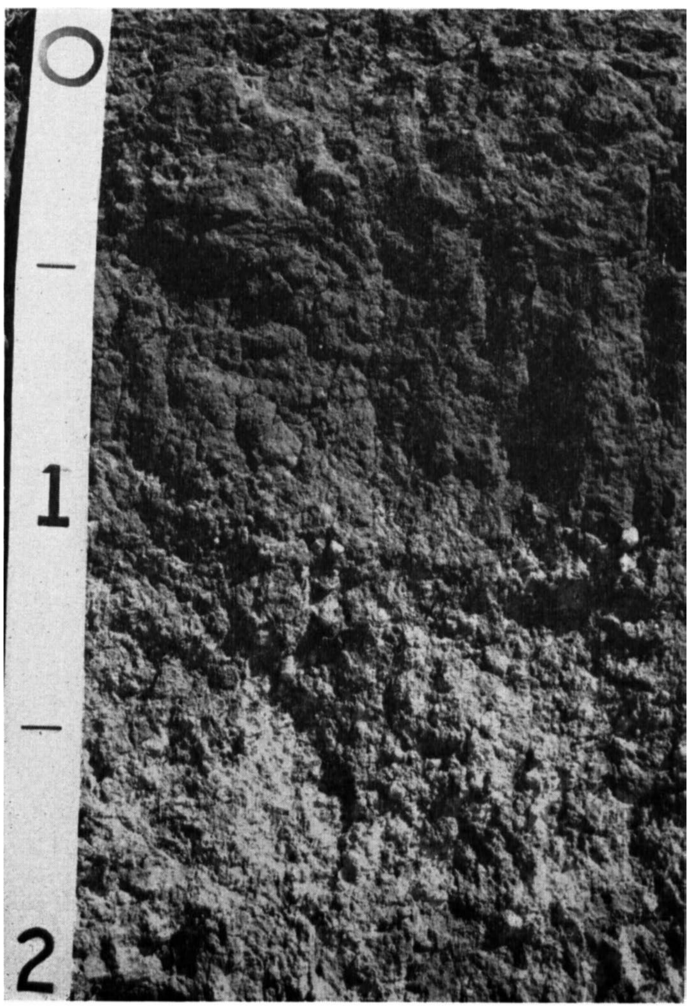

Figure 6.—**Profile of Mansker loam.**

Included with this soil in mapping are small areas of Portales loam, Mansker fine sandy loam, and Amarillo fine sandy loam, all with slopes of 1 to 3 percent, and small areas of Potter soils. (Capability unit IVe–9, dryland; capability unit IIIe–10, irrigated; Mixed Plains range site)

Olton Series

The soils of the Olton series are deep, dark brown, and nearly level. They occur in the eastern part of the county.

These soils have a surface layer of dark-brown loam that is granular in structure and about 7 inches thick.

The clay loam subsoil is blocky in structure and about 31 inches thick. The subsoil is dark brown in the upper 5 inches and reddish brown in the lower 26 inches. It is calcareous in the lowest 14 inches.

The upper part of the substratum, at a depth of 38 inches, is calcareous, pink clay loam in which calcium carbonate has accumulated. This layer is at a depth of about 38 inches. The lower substratum is reddish-yellow or pink, calcareous clay loam several feet thick.

The Olton soils are well drained but slowly permeable. They have high water-holding capacity and high natural fertility and are only slightly susceptible to wind and water erosion.

The Olton soils are browner than the Amarillo soils and have a more clayey subsoil. They are redder than the Portales soils and have a more compact subsoil, and they are deeper and have a more compact subsoil than the Mansker soils.

Although the Olton soils are droughty if dry-farmed, they are well suited to cultivation and are productive if irrigated. Cotton, grain sorghum, and small grains are generally irrigated successfully. Areas of these soils in range support a good turf of blue grama and buffalograss.

Olton loam, 0 to 1 percent slopes (OtA).—This soil is common in the northeastern part of the county. The surface layer is dark-brown loam about 7 inches thick. In some cultivated areas, part of the clay and silt in the plow layer has been blown away, and the upper 3 or 4 inches is coarser than it was before cultivation. A profile of Olton loam is shown in figure 7.

Included with this soil in mapping are small areas of Amarillo loam, Zita loam, Portales loam, and Mansker loam, all with slopes of 0 to 1 percent. (Capability unit IIIce–2, dryland; capability unit IIe–1, irrigated; Deep Hardland range site)

Portales Series

The soils of the Portales series are moderately deep, calcareous, grayish brown, and nearly level to gently sloping. They occur throughout the county.

These soils have a surface layer of calcareous, grayish-brown loam to fine sandy loam that is granular in structure. This layer is generally about 8 inches thick but ranges from 5 to 10 inches in thickness.

The subsoil is calcareous, light brownish-gray clay loam of prismatic structure. It is about 26 inches thick.

The upper substratum occurs at a depth of about 34 inches. It is strongly calcareous, white clay loam in which calcium carbonate has accumulated. The lower sub-

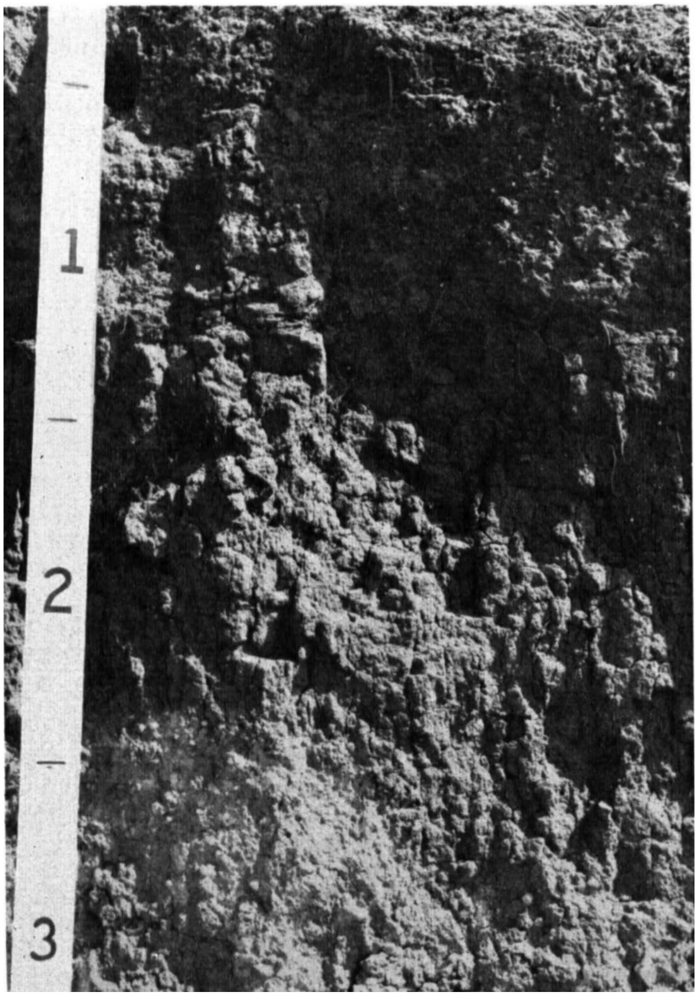

Figure 7.—**Profile of Olton loam.**

stratum is very pale brown, calcareous clay loam several feet thick.

These soils are well drained. Their internal drainage is medium, and their permeability is moderately rapid. They have moderate water-holding capacity and moderate natural fertility and are susceptible to wind and water erosion.

The Portales soils are shallower and grayer than the Amarillo soils, are grayer and more permeable in the subsoil than the Olton soils, are deeper and less limy than the Mansker and Arch soils, and are deeper and less sloping than the Drake soils.

The Portales soils are well suited to cotton and grain sorghum. They are suited to irrigation and are generally irrigated. Blue grama, side-oats grama, buffalograss, and other native grasses thrive on areas of these soils in range.

Portales fine sandy loam, 0 to 1 percent slopes (PfA).—This soil occurs mainly in the central and western parts of the county. The surface layer is grayish-brown fine sandy loam about 8 inches thick. In some cultivated areas, part of the clay and silt in the plow layer has been blown away, and the upper 3 to 5 inches of the plow layer is sandier than it was before cultivation.

Included with this soil in mapping are small areas of Mansker fine sandy loam, Portales loam, Amarillo fine sandy loam, and Zita fine sandy loam, all with slopes of 0 to 1 percent, and small areas of Portales fine sandy loam, 1 to 3 percent slopes, and Arch clay loam. (Capability unit IIIe-6, dryland; capability unit IIe-5, irrigated; Mixed Plains range site)

Portales fine sandy loam, 1 to 3 percent slopes (PfB).—This soil is in the central and western parts of the county. The surface layer is grayish-brown fine sandy loam about 7 inches thick. In some cultivated areas, part of the clay and silt in the plow layer has been blown away, and the upper 3 or 4 inches is coarser than it was before cultivation. There are also small areas where the surface layer has been thinned by water erosion.

The subsoil is about 23 inches thick, and the substratum occurs at a depth of about 30 inches.

Included with this soil in mapping are small areas of Portales fine sandy loam, 0 to 1 percent slopes, and small areas of Amarillo fine sandy loam, Mansker fine sandy loam, and Drake soils, all with slopes of 1 to 3 percent. (Capability unit IIIe-6, dryland; capability unit IIIe-6, irrigated; Mixed Plains range site)

Portales loam, 0 to 1 percent slopes (PmA).—This soil is in the northern part of the county. The surface layer is calcareous, brown loam about 7 inches thick. The subsoil is about 21 inches thick, and the substratum occurs at a depth of 28 inches.

Included with this soil in mapping are small areas of Mansker loam, Amarillo loam, and Olton loam, all with 0 to 1 percent slopes, and small areas of Portales loam, 1 to 3 percent slopes. (Capability unit IIIce-3, dryland; capability unit IIe-3, irrigated; Mixed Plains range site)

Portales loam, 1 to 3 percent slopes (PmB).—This soil is most common in the eastern part of the county. The surface layer is calcareous, brown loam about 7 inches thick. There are small areas where the surface layer has been thinned by water erosion.

The subsoil is about 20 inches thick, and the upper substratum is at a depth of about 27 inches.

Included with this soil in mapping are small areas of Mansker loam, Portales fine sandy loam, and Amarillo loam, all with slopes of 1 to 3 percent, and small areas of Portales loam, 0 to 1 percent slopes. (Capability unit IIIe-3, dryland; capability unit IIIe-4, irrigated; Mixed Plains range site)

Potter Series

The soils of the Potter series are very shallow, calcareous, and grayish brown. These sloping soils occur mainly in the north-central part of the county.

Potter soils have a surface layer of calcareous, grayish-brown gravelly loam or gravelly fine sandy loam that is granular in structure and about 7 inches thick. This layer lies directly over the substratum, which is a thick, loose bed of pinkish-white, strongly calcareous caliche.

The Potter soils are well drained. Their internal drainage is good, and they are moderately permeable. These soils have low water-holding capacity and low natural fertility. They are highly susceptible to water erosion and moderately susceptible to wind erosion.

The Potter soils are browner and much shallower than the Amarillo soils. They are shallower and more sloping than the Mansker or Portales soils, and they are browner,

more sloping, and have a softer substratum than the Kimbrough soils.

These soils are entirely unsuitable for cultivation. Their extremely shallow depth and steep slopes limit their production. They are in native grasses and are used only for range in this county.

Potter soils (5 to 15 percent slopes) (Ps).—These soils are most common on steep slopes in the northern part of the county.

Included with these soils in mapping are small areas of Berthoud-Mansker loams, 3 to 5 percent slopes. (Capability unit VIIs-1 dryland; Shallow Land range site)

Randall Series

The soils of the Randall series are deep, dark gray, clayey, and level. These soils are in intermittent lakes that occur throughout the county.

The surface layer is about 20 inches thick. It is generally clay but ranges from clay to fine sandy loam in recent windblown or water-laid deposits.

The subsoil is very firm, massive, gray clay about 18 inches thick. It overlies a substratum of firm, gray clay at a depth of about 38 inches.

Randall soils are poorly drained. They have poor internal drainage and are very slowly permeable. They have high water-holding capacity and high natural fertility, but production is limited by wetness from periodic flooding.

These soils have a darker, more clayey surface layer than the Zita or Amarillo soils. They are darker, less limy, and in more depressed positions than the Church or Arch soils.

The Randall soils are poorly suited to cultivation. In years of low rainfall, however, when flooding is infrequent, some of the areas on lake floors are productive. Grain sorghum and small grains are the usual crops, or the soils may be used for pasture. Native grasses, such as buffalograss, survive in small lakes where the water stands for a shorter time.

Randall clay (0 to 1 percent slopes) (Ra).—This soil occurs on beds of the intermittent lakes throughout the county. The surface layer is dark-gray clay about 20 inches thick.

Included with this soil in mapping are small areas of Zita loam, 0 to 1 percent slopes, Church clay loam, and Arch clay loam. (Capability unit VIw-1, dryland; areas of this soil are placed in the same range site as that of the surrounding soils.)

Randall fine sandy loam (0 to 1 percent slopes) (Rf).—This soil is in the western part of the county. The surface layer is granular, brown fine sandy loam about 10 inches thick. The subsoil is gray or dark-gray clay about 30 inches thick. The gray, calcareous clay substratum is at a depth of 40 inches.

This soil is in sandy areas where runoff is reduced. Crops are harvested more frequently on this soil than on Randall clay because the hazard of flooding is somewhat less.

Included with this soil in mapping are small areas of Zita fine sandy loam, 0 to 1 percent slopes, and Portales fine sandy loam, 0 to 1 percent slopes. (Capability unit IVw-1, dryland; areas of this soil are placed in the same range site as that of the surrounding soils.)

Spur Series

The Spur series consists of deep, dark-brown soils on bottom lands of small drainageways in the county.

These soils have a granular loam surface layer about 6 inches thick.

The subsoil, also granular, is calcareous, grayish-brown clay loam in the upper 18 inches and calcareous, pale-brown clay loam in the lower part.

The substratum occurs at a depth of 50 inches. It is strongly calcareous, gray clay loam several feet thick.

Spur soils are well drained. Their internal drainage is medium, and they are moderately permeable. They have good water-holding capacity and high natural fertility and are slightly susceptible to wind and water erosion.

The Spur soils are in more depressed positions and are darker than the Amarillo or Portales soils. They have a sandier subsoil than the Randall soils and a less limy substratum than the Zita soils. The Spur soils occur in drainageway floors in an intricate pattern with the Bippus soils and have been mapped in an undifferentiated unit with those soils (fig. 8).

Spur soils are well suited to cotton, grain sorghum, and small grains, and also to native grasses. Farming these soils is difficult, however, because they are in narrow valleys with poorer, shallower, more sloping soils on either side. They are well suited to irrigation but are not commonly irrigated.

Spur and Bippus soils (0 to 1 percent slopes) (Sp).—These soils occur in the nearly level, narrow bottoms of the small drainageways. In some cultivated areas, part of the clay and silt in the plow layer has been blown away and coarser soil has been left in the upper 5 or 6 inches.

Some areas have also received soil that eroded from adjacent slopes. The texture of the surface soil in these areas ranges from clay loam to fine sandy loam.

Included with this soil in mapping are small areas of Zita fine sandy loam, Zita loam, Portales fine sandy loam, and Portales loam, all with slopes of 0 to 1 percent. (Capability unit IIe-1, dryland; capability unit IIe-2, irrigated; Bottom Land range site; Deep Hardland range site)

Stegall Series

The Stegall series consists of shallow, compact, dark-brown, nearly level soils. These soils are in the northwestern part of the county.

The surface layer is dark-brown loam that has granular structure and is about 7 inches thick.

The subsoil, about 11 inches thick, is reddish-brown clay loam that has blocky structure.

Underlying the subsoil at a depth of 18 inches is a substratum of white, hard caliche.

These soils are well drained. Their internal drainage is medium, and they are slowly permeable. They have moderate water-holding capacity and high natural fertility, but their production is limited by the shallow depth to the hard substratum. They are moderately susceptible to wind and water erosion.

The Stegall soils have a more clayey subsoil than the Arvana soils. They are redder than the Mansker soils and have a firmer substratum. They are redder and less

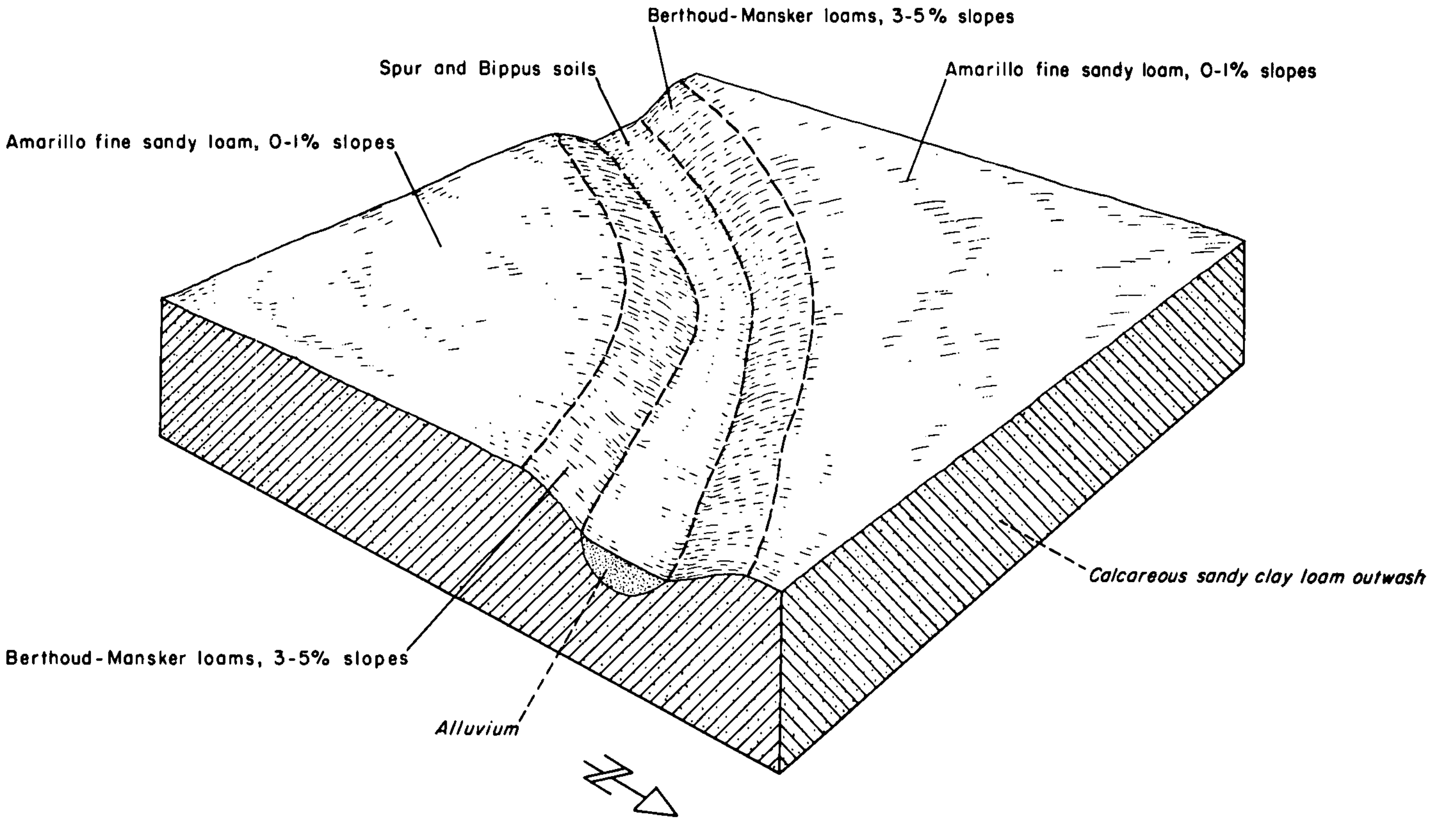

Figure 8.—**Soils associated with small drainageways.**

deep than the Portales soils and are much less deep than the Amarillo soils, but they are deeper than the Kimbrough soils. In this county Stegall soils are so intermingled with Lea soils that they are mapped only in a complex with those soils.

Stegall soils are poorly suited to cultivation. Because of the lack of water in this area, they are not irrigated. Blue grama, buffalograss, and other native grasses grow well on these soils.

Stegall-Lea loams, shallow (0 to 1 percent slopes) (Sl).—These soils are in the northwestern part of the county. The two soils in this complex are similar, but the Lea soils are grayer and are calcareous. Both the Stegall and Lea soils have a substratum of white, hard caliche at about the same depth.

Included with these soils in mapping are small areas of Mansker loam, Portales loam, and Arvana fine sandy loam, shallow, all with slopes of 0 to 1 percent, and small areas of Kimbrough soils. (Capability unit IVe–9, dryland; capability unit IIIe–10, irrigated; Deep Hardland range site)

Tivoli Series

The Tivoli series consists of deep, loose, sandy, undulating soils in a small area in the north-central part of the county.

The surface layer is loose, pale-brown fine sand about 12 inches thick. It directly overlies the substratum.

The substratum occurs at a depth of about 12 inches. It consists of loose, light-brown fine sand, several feet thick.

These soils are well drained, and their internal drainage and permeability are very rapid. They have low water-holding capacity and low natural fertility and are highly susceptible to wind erosion.

These soils have a sandier substratum than Brownfield, Amarillo, or Portales soils.

Tivoli soils are entirely unsuitable for cultivation. The very severe hazard of wind erosion and the low fertility limit the use of these soils to range. They are well suited to such native grasses as Indiangrass and big bluestem.

Tivoli fine sand (Tv).—This soil is in the north-central part of the county. It occurs on 3 to 8 percent slopes. The surface layer is loose, pale-brown fine sand about 12 inches thick.

Included with this soil in mapping are small areas of Amarillo loamy fine sand, Brownfield fine sand, and Kimbrough soils. (Capability unit VIIe–1, dryland; Deep Sand range site)

Zita Series

The soils of the Zita series are moderately deep, dark grayish brown, and nearly level. They occur throughout the county.

These soils have a dark grayish-brown surface layer that ranges from loam to fine sandy loam and is granular in structure. The thickness of this layer is generally about 7 inches but ranges from 5 to 12.

The subsoil is clay loam of subangular blocky structure. In the upper 11 inches, it is dark grayish brown, but in the lower 6 inches, it is light brownish gray and is calcareous.

At a depth of about 24 inches is the upper substratum, a strongly calcareous layer of white clay loam in which calcium carbonate has accumulated. The lower part of the substratum occurs at a depth of 35 inches. It is very pale brown clay loam several feet thick.

These soils are well drained. They have medium internal drainage and are moderately permeable. They have high water-holding capacity and high natural fertility, but they are susceptible to wind and water erosion.

The Zita soils are darker and less deep than the Amarillo soils. They are not so red as the Arvana soils and have a softer substratum. Their surface layer is noncalcareous and darker than that of the Portales soils. They have a sandier subsoil and are shallower than the Olton soils.

Zita soils are well suited to cotton and grain sorghum. Irrigation of these soils is common and successful. Blue grama, buffalograss, side-oats grama, and other native grasses thrive on these soils in range.

Zita fine sandy loam, 0 to 1 percent slopes (ZfA).—This soil is mainly in the central and western parts of the county. The surface layer is granular, dark grayish-brown loam about 6 inches thick. In some cultivated areas, part of the clay and silt in the plow layer has been blown away, and coarser soil has been left in the upper 3 to 5 inches.

The subsoil is about 18 inches thick. It is a dark grayish-brown sandy clay loam of prismatic structure. The lower 5 inches is calcareous clay loam. The substratum occurs at a depth of 23 inches.

Included with this soil in mapping are small areas of Portales fine sandy loam, Amarillo fine sandy loam, and Zita loam, all with slopes of 0 to 1 percent. (Capability unit IIIe–4, dryland; capability unit IIe–4, irrigated; Mixed Land range site)

Zita loam, 0 to 1 percent slopes (ZmA).—This soil is in the eastern part of the county. The surface layer is dark grayish-brown loam about 7 inches thick.

Included with this soil in mapping are small areas of Zita fine sandy loam, Amarillo loam, and Portales loam, all with slopes of 0 to 1 percent. (Capability unit IIIce–2, dryland; capability unit IIe–2, irrigated; Deep Hardland range site)

Use and Management of Soils

The use and management of soils for dryland farming, irrigation farming, range, and engineering are discussed in this section. In the discussion of each method of farming, some practices are suggested, the soils are grouped into capability units, and each capability unit is described. In the subsection "Yield of Crops," predicted yields are given for the principal crops on dryland and irrigated soils under two levels of management. Special emphasis is given to the control of wind erosion, which is a hazard common to farming, range management, and engineering.

Wind Erosion

Every farm in Hockley County is subject to damage by wind. Therefore, wind erosion is a major problem in soil management. Effective control of erosion requires the cooperation of all farmers in an area, because material blown from unprotected fields damages crops on nearby farms.

Effects of wind erosion.—Crops are lost, and highways, railroads, shelterbelts, fences, and farm buildings are partly buried by severe duststorms. These storms are disagreeable and in some cases, unbearable, on farms and in cities.

The most serious effect of duststorms is the loss of fine soil particles, which are sorted from the coarse particles and moved to distant places. The coarse particles of soil are not fertile. Plants get their food from the fine particles.

In fields that are not protected from wind erosion, the soils gradually lose their tilth, plowpans easily form, surfaces crust, seeds germinate poorly, and yields decline.

Nearly every field in Hockley County has been eroded to some degree by wind. The moderately coarse and coarse textured surface soils have been affected most, but even the finer textured soils appear to be coarser than when first cultivated.

Control of wind erosion.—The successful control of wind erosion on cropland depends on the surface roughness of fields and the amount of organic matter in the soil. Fields that are considerably roughened by clods or crop residue resist wind erosion better than smooth fields. The roughness of a field depends on the size, shape, and spacing of clods, the spacing of furrows, and the height, spacing, and type of vegetation. Tillage is effective if enough clay and moisture are in the soil to produce clods and if sufficient amount of stubble is left on the surface.

The best way to control wind erosion is to maintain a vegetative cover or to properly manage crop residue. Residue, or stubble, from a previous crop slows the wind speed at the ground surface. Standing stubble reduces wind force more than flattened stubble, and close-spaced stubble reduces it more than wide-spaced stubble. If adequate residue is not available, fields can be roughened by emergency tillage (fig. 9).

Capability Groups of Soils

The capability classification is a grouping of soils that shows, in a general way, how suitable they are for most kinds of farming. It is a practical grouping based on

Figure 9.—**Emergency tillage. Because of insufficient crop residue, it was necessary to chisel this Amarillo fine sandy loam to help control wind erosion.**

limitations of the soils, the risk of damage when they are used, and the way they respond to treatment.

In this system all the kinds of soil are grouped at three levels, the capability class, subclass, and unit. The eight capability classes in the broadest grouping are designated by Roman numerals I through VIII. In class I are the soils that have few limitations, the widest range of use, and the least risk of damage when they are used. The soils in the other classes have progressively greater natural limitations. In class VIII are soils and landforms so rough, shallow, or otherwise limited that they do not produce worthwhile yields of crops, forage, or wood products.

The subclasses indicate major kinds of limitations within the classes. Within most of the classes there can be up to four subclasses. The subclass is indicated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* means that water in or on the soil will interfere with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the country, indicates that the chief limitation is climate that is too cold or too dry. A subclass may have a combination of limitations, for example IIIce.

In class I there are no subclasses, because the soils of this class have few or no limitations. Class V can contain, at the most, only subclasses *w*, *s*, and *c*, because the soils in it have little or no erosion hazard but have other limitations that limit their use largely to pasture, range, woodland, or wildlife.

Within the subclasses are the capability units, groups of soil enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping of soils for many statements about their management. Capability units are generally identified by numbers assigned locally, for example, IIe-1 or IIIe-2. These numbers are not consecutive in Hockley County because they are part of a statewide system.

Soils are classified in capability classes, subclasses, and units in accordance with the degree and kind of their permanent limitations; but without consideration of major and generally expensive landforming that would change the slope, depth, or other characteristics of the soil; and without consideration of possible but unlikely major reclamation projects.

The soils of Hockley County have been grouped in separate capability classifications for dryland farming and for irrigation farming. The classification system and capability units for dryland are in the subsection "Management of Dryland," and those for irrigated soils are in the subsection "Management of Irrigated Soils."

Management of Dryland

Conserving moisture, controlling erosion, and maintaining fertility and tilth are necessary in cultivating soils under dryland conditions in Hockley County. Most good farming practices accomplish more than one purpose and can be used on most of the dryland in the county. A discussion of some of the practices follows.

***Figure 10.*—A waterway under construction in a field of Portales loam, 1 to 3 percent slopes. This waterway will be grassed and used to carry excess water down the slope to the playa lake in the background.**

Moisture is the limiting factor in producing crops in Hockley County. The rainfall is limited and often occurs during intense storms that cause runoff and erosion. Some practices that conserve moisture are terracing, contour farming, managing crop residue, and emergency tillage.

Terracing is a common practice used by farmers to keep rain where it falls and retain it for crops. Terraces are a series of level ridges, 1 to 2 feet high, constructed across a field. A diversion terrace is a single, large, level ridge that intercepts runoff and carries it to a suitable outlet. This type of terrace may be used in irrigated areas for protection of fields. All terraces must have a suitable outlet for excess water, such as a pasture or a grassed waterway (fig. 10).

Contour farming is the practice of planting crops on the contour, so that rows are level, to check the flow of water (fig. 11). Contour farming can be used alone or in combination with terraces.

Managing crop residue involves the planting, cultivating, and harvesting of crops in a way that leaves as much residue as possible on or in the soil to catch moisture, to

***Figure 11.*—A dryland field of Amarillo fine sandy loam, 1 to 3 percent slopes, listed on the contour.**

***Figure 12.*—A field of Amarillo fine sandy loam, 0 to 1 percent slopes, that has much of the crop residue remaining on the surface after plowing.**

prevent the soil from drying, and to protect the soil from wind and water erosion (fig. 12). Barnyard manure or cotton burs applied to the soil and kept on the surface are also effective (fig. 13). Managing crop residue is a good practice on both dryland and irrigated soils.

In years of low rainfall, when crop residue is not sufficient to protect the soil from the wind, emergency tillage may be used, but this practice, as the term indicates, is to be used only when other methods fail. Emergency tillage is the process of chiseling, listing, or otherwise roughening the soil for protection against wind erosion. The tillage must be deep enough to form resistant clods that are large enough to deter soil blowing.

In Hockley County commercial fertilizer is not generally used for dryland crops. Because of the varying rainfall, the economic conditions, and the general high fertility of the soils, the benefits of fertilizing dryland crops are unpredictable. Crops grown on irrigated soils respond favorably to fertilizer, however, and this practice is discussed in the subsection on the management of irrigated soils.

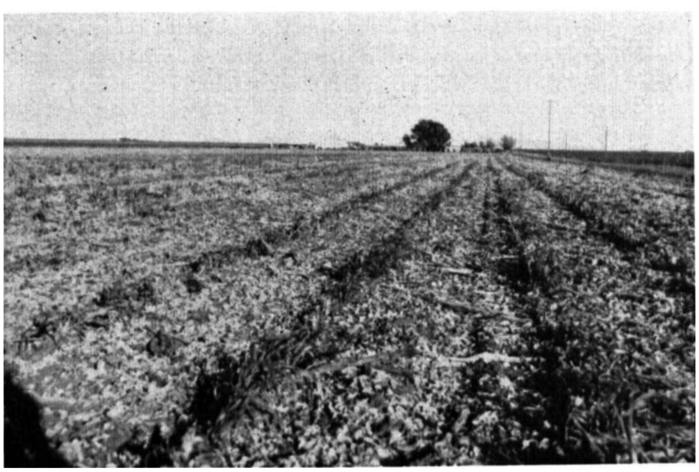

***Figure 13.*—Approximately 5 tons of cotton burs per acre have been applied to this field of Amarillo fine sandy loam to protect it from wind.**

In planning the management of soils, farmers must first consider the crops on which they depend for an income. Some of these crops deplete the soil, whereas others improve it. Therefore, a cropping system should be planned that will maintain the productivity of the soil as well as obtain good yields.

A cropping system is basically designed to balance soil-depleting crops with soil-improving crops. Soil-improving crops are those that return large amounts of residue to the soil.

A cropping system is not necessarily a rotation, but it can be a rotation or a sequence of crops.

In Hockley County a cropping system for dryland farming must be based on two major crops—cotton and grain sorghum. Cotton, a low-residue crop, is grown in rotation with grain sorghum, a high-residue crop that can be managed for soil protection and improvement (fig. 14). The hazard of wind erosion and the need for organic matter in the soil determine the frequency of planting a high-residue crop.

In planning a cropping system, stripcropping should be considered. This is the practice of alternating strips of

***Figure 14.*—Grain sorghum ready for harvest on Olton loam, 0 to 1 percent slopes. Grain sorghum is a high-residue crop.**

grain sorghum, a small grain, or some other close-growing crop with strips of a clean-cultivated crop such as cotton. The close-growing crop protects the soil from wind erosion during the growing season, and its residue helps to protect the soil during the winter.

Cover cropping also protects the soil and improves it (fig. 15). In years when moisture is available, a small grain can be seeded in a low-residue crop to protect the soil from wind during the winter. Sorghum, millet, or similar crops can be planted late to provide protection in areas where other crops have failed, or on fallow areas, even though these crops may not mature.

Capability groups for dryland

The classes in the capability system for dryland soils and the subclasses and units are described in the list that follows.

Class I. Soils that have few limitations that restrict their use. (There are no soils in Hockley County in this class.)

Figure 15.—**A cover crop of oats and vetch broadcast in sorghum stubble for protection during the winter blowing season. This crop is on Amarillo fine sandy loam, 0 to 1 percent slopes.**

Class II. Soils that have some limitations that reduce the choice of plants or require moderate conservation practices.

Subclass IIe. Soils subject to moderate erosion if they are not protected.

Unit IIe–1, dryland.—Deep, nearly level soils that are on bottom lands and have a medium or moderately fine textured surface layer and a moderately fine textured subsoil.

Class III. Soils that have severe limitations that reduce the choice of plants, require special conservation practices, or both.

Subclass IIe. Soils subject to severe water erosion and moderate or slight wind erosion if they are not protected.

Unit IIIe–2, dryland.—Deep, gently sloping soils that have a medium or moderately fine textured surface layer and a moderately fine textured subsoil.

Unit IIIe–3, dryland.—Moderately deep, gently sloping, permeable soils that have a medium-textured surface layer and a moderately fine textured subsoil.

Unit IIIe–4, dryland.—Deep and moderately deep, nearly level and gently sloping soils that have a moderately coarse textured surface layer and a moderately fine textured subsoil.

Unit IIIe–6, dryland.—Moderately deep, nearly level to gently sloping, permeable soils that have a moderately coarse textured surface layer and a moderately fine textured subsoil.

Subclass IIIce. Soils that are droughty and susceptible to slight water or wind erosion if not protected.

Unit IIIce–2, dryland.—Deep, nearly level soils that have a medium-textured surface layer and a moderately fine textured subsoil.

Unit IIIce–3, dryland.—Moderately deep, nearly level, permeable soils that have a medium-textured surface layer and a moderately fine textured subsoil.

Class IV. Soils that have very severe limitations that restrict the choice of plants, require very careful management, or both.

Subclass IVe. Soils subject to moderate to severe wind erosion and slight to severe water erosion if not protected.

Unit IVe–1, dryland.—Moderately deep, permeable, moderately sloping soils that have a medium-textured surface layer and a moderately fine textured subsoil.

Unit IVe–4, dryland.—Deep, moderately sloping soils that have a moderately coarse textured surface layer and a moderately fine textured subsoil.

Unit IVe–7, dryland.—Deep, nearly level to gently sloping soils that have a coarse-textured surface layer and a moderately fine textured subsoil.

Unit IVe–9, dryland.—Shallow, nearly level to gently sloping soils that have a medium-textured surface layer and a moderately fine textured subsoil.

Unit IVe–10, dryland.—Shallow, nearly level to gently sloping soils that have a moderately coarse textured surface layer and a moderately fine textured subsoil.

Subclass IVw. Soils that are severely limited by excess water.

Unit IVw–1, dryland.—Deep, level soils that have a moderately coarse textured surface layer and a fine-textured subsoil and are periodically flooded.

Subclass IVes. Soils that are subject to severe wind erosion and are limited by depth of root zone.

Unit IVes–1, dryland.—Shallow and moderately deep soils that are limy, permeable, and nearly level to gently sloping and have a moderately coarse or moderately fine textured surface layer and a moderately fine textured subsoil.

Class V. Soils that are not likely to erode but have other limitations, that are impractical to remove without major reclamation and that limit their use largely to pasture or range, woodland, or wildlife. (There are no soils in this class in Hockley County.)

Class VI. Soils that have severe limitations that make them generally unsuitable for cultivation and limit their use largely to pasture, range, or wildlife.

Subclass VIe. Soils subject to severe water erosion or wind erosion if not protected.

Unit VIe–3, dryland.—Shallow, moderately sloping to steeply sloping, limy soils that have a moderately coarse to moderately fine textured surface layer and subsoil.

Unit VIe–6, dryland.—Deep, nearly level to gently sloping soils that have a coarse-textured surface layer and a moderately fine textured subsoil.

Subclass VIw. Soils that are severely limited by excess water.

Unit VIw–1, dryland.—Deep, level, poorly drained soils that have a fine-textured surface layer and subsoil.

Class VII. Soils that have very severe limitations that make them unsuitable for cultivation without major reclamation, and that restrict their use largely to pasture, range, or wildlife cover.

Subclass VIIe. Soils that are subject to very severe wind or water erosion if not protected.

Unit VIIe-1, dryland.—Deep, undulating dune soils that have a coarse-textured surface layer and subsoil.

Subclass VIIs. Soils that have very severe root-zone limitations.

Unit VIIs-1, dryland.—Very shallow, nearly level to sloping soils that have a moderately fine textured surface layer.

Class VIII. Soils and landforms that have limitations that preclude their use, without major reclamation, for commercial production of plants; and restrict their use to recreation, wildlife, water supply, or esthetic purposes. (There are no soils in class VIII in Hockley County.)

Management of dryland soils by capability units

In this subsection each capability unit is described, the soils in it are listed, and the use and management of the soils are discussed.

CAPABILITY UNIT IIe-1, DRYLAND

The Spur and Bippus soils, an undifferentiated group, are the only soils in this capability unit.

These deep, nearly level soils are on bottom land. They have a medium or moderately fine textured surface layer and a moderately fine textured subsoil.

In total area, these soils cover less than 1 percent of the county. They are used mainly for grain sorghum and small grain, but also for cotton, forage sorghum, and native range.

Spur and Bippus soils are fertile and productive. They are suitable for cotton, but their use for this purpose is hampered because they are located in narrow areas surrounded by sloping, shallow, and moderately deep soils. The hazard of wind and water erosion is slight.

Practices that help control erosion and maintain soil tilth are (1) using a cropping system that includes grain sorghum, small grain, or some other high-residue crop at least half the time and (2) leaving all residue on or near the surface. An example of a suitable cropping system is a year of cotton followed by a year of grain sorghum.

In years of poor rainfall, when crop residue is insufficient to control erosion, it may be necessary to roughen the surface of cultivated fields by chiseling or listing.

CAPABILITY UNIT IIIe-2, DRYLAND

In this unit are deep, gently sloping soils with a medium or moderately fine textured surface layer and a moderately fine textured subsoil. The soils are—

Amarillo loam, 1 to 3 percent slopes.
Bippus clay loam, 1 to 3 percent slopes.

About 90 percent of the Amarillo soil is cultivated, mainly to grain sorghum and cotton, and the rest is in native range. Practically all of the Bippus soil is used as range.

These soils are suitable for cultivation if runoff is checked. They are moderately to highly fertile and have a moderate water-holding capacity. The hazard of wind and water erosion is moderate.

Terracing these soils and farming them on the contour help to control water erosion and increase yields.

Other practices that help control erosion and maintain soil tilth are (1) using a cropping system that includes a high-residue crop, such as grain sorghum or small grain, at least two-thirds of the time, and (2) leaving all residue on or near the surface. An example of a suitable cropping system is a year of grain sorghum, a year of cotton, and another year of grain sorghum.

In years of poor rainfall, when crop residue is insufficient to control erosion, chiseling or listing of cultivated fields may be necessary to roughen the surface.

CAPABILITY UNIT IIIe-3, DRYLAND

Portales loam, 1 to 3 percent slopes, is the only soil in this capability unit. This moderately deep soil is gently sloping and permeable. It has a medium-textured surface layer and a moderately fine textured subsoil.

About 90 percent of this soil is cultivated, mainly to grain sorghum and cotton, and the rest is in range.

If runoff is controlled, this soil is suitable for cultivation. It has moderate fertility and water-holding capacity and is moderately susceptible to wind and water erosion.

Terracing and contour farming help control water erosion and obtain the best yields.

Other practices that help control erosion and also maintain good tilth are (1) using a cropping system that includes grain sorghum, a small grain, or some other high-residue crop at least two-thirds of the time, and (2) leaving crop residue on or near the surface to provide a protective cover and roughness.

In years of poor rainfall, when there is not enough crop residue to control erosion, it may be necessary to chisel or list cultivated fields for surface roughness.

CAPABILITY UNIT IIIe-4, DRYLAND

This unit consists of deep and moderately deep, nearly level and gently sloping soils that have a moderately coarse textured surface layer and a moderately fine textured subsoil. The soils are—

Amarillo fine sandy loam, 0 to 1 percent slopes.
Amarillo fine sandy loam, 1 to 3 percent slopes.
Arvana fine sandy loam, 0 to 1 percent slopes.
Arvana fine sandy loam, 1 to 3 percent slopes.
Zita fine sandy loam, 0 to 1 percent slopes.

These soils make up about half the acreage of Hockley County, and they are generally in the central and western parts. Cotton and grain sorghum are the main crops.

These soils are moderately fertile and productive, but their surface layer is moderately coarse textured and they are susceptible to moderate wind erosion. The more sloping soils are moderately susceptible to water erosion, and the nearly level soils are slightly susceptible.

Terracing and contour farming reduce runoff and help control water erosion on these soils (fig. 16).

Practices that help maintain soil tilth and also help control erosion are (1) using a cropping system that includes grain sorghum, small grain, or some other high-residue crop at least two-thirds of the time, and (2) managing the residue so that all of it will remain on or near the surface. An example of a suitable cropping system is a year

Figure 16.—**Gully in an unterraced field on gently sloping Amarillo fine sandy loam after a heavy rain.**

of grain sorghum, a year of cotton, and another year of grain sorghum.

In years of poor rainfall, when crop residue is not sufficient to protect the soil, it may be necessary to roughen cultivated fields by chiseling or listing.

CAPABILITY UNIT IIIe-6, DRYLAND

In this unit are moderately deep, nearly level to gently sloping, permeable soils with a moderately coarse textured surface layer and a moderately fine textured subsoil. The soils are—

Portales fine sandy loam, 0 to 1 percent slopes.
Portales fine sandy loam, 1 to 3 percent slopes.

These soils occur in one large body in the north-central part of the county and in scattered smaller areas throughout the central and western sections. Their total area is 40,000 acres. Cotton and grain sorghum are the main crops.

These soils are moderately fertile and productive. The hazard of water erosion is moderate on slopes of 1 to 3 percent and slight on those less than 1 percent. Because of their fine sandy loam surface layer, the hazard of wind erosion is moderate on these soils.

Terracing and contour farming are practices that help control runoff and erosion on these soils and provide for the storage of moisture for crops.

Using a cropping system that includes grain sorghum, small grain, or some other high-residue crop at least two-thirds of the time provides residue for erosion control and soil maintenance. An example of a suitable cropping system is a year of grain sorghum, a year of cotton, and another year of grain sorghum. Wind erosion is better controlled if the residue remains on or near the surface at all times.

In years of poor rainfall, when crop residue is insufficient to control erosion, it may be necessary to chisel or list cultivated fields to roughen the surface.

CAPABILITY UNIT IIIce-2, DRYLAND

This capability unit is made up of nearly level soils that have a medium-textured surface layer and a moderately fine textured subsoil. The soils are—

Amarillo loam, 0 to 1 percent slopes.
Olton loam, 0 to 1 percent slopes.
Zita loam, 0 to 1 percent slopes.

These soils have a total area of 125,000 acres and are most common in the eastern part of the county. Cotton and grain sorghum are the main crops. Some forage sorghum and small grain are also grown.

Although these soils are highly fertile, they absorb rainfall slowly and release moisture to plants slowly. They are not productive in years of low rainfall. The hazard of water erosion is slight and that of wind erosion is slight to moderate.

Rainfall for crop use can be retained by terracing and contour farming.

A cropping system that includes grain sorghum, small grain, or some other high-residue crop at least half the time provides residue for erosion control and soil maintenance. An example of such a system is a year of cotton and a year of grain sorghum. A suitable alternative would be to interplant a cover crop between the cotton rows on half of the cotton land each year.

Crop residue is most effective in controlling wind erosion if it is left on the surface.

In years of poor rainfall, when crop residue is not sufficient to control erosion, chiseling or listing cultivated fields may be necessary to roughen the surface.

CAPABILITY UNIT IIIce-3, DRYLAND

Portales loam, 0 to 1 percent slopes, is the only soil in this capability unit. This moderately deep, nearly level, permeable soil has a medium-textured surface layer and a moderately fine textured subsoil.

This soil is most common in the eastern part of the county and generally occurs in scattered areas of 10 to 100 acres. Cotton and grain sorghum are the principal crops.

This soil is moderately fertile, but it is slow to absorb rainfall and therefore is not productive in years of low rainfall. The hazard of water erosion is slight and that of wind erosion is slight to moderate.

Sufficient residue to help control wind erosion can be provided by a cropping system in which a year of cotton is followed by a year of grain sorghum, small grain, or other high-residue crop.

Small grain, adapted permanent grasses, and forage or grain sorghum, grown for several years, also provide cover and residue that protect the soil and improve tilth.

Wind erosion is best controlled by leaving crop residue on the surface.

Terracing and contour farming help retain rainfall and store it for crop use. In years of poor rainfall, when crop residue is not sufficient to control erosion, it may be necessary to chisel or list the soil to roughen the surface.

CAPABILITY UNIT IVe-1, DRYLAND

Berthoud-Mansker loams, 3 to 5 percent slopes, are the only soils in this capability unit. These moderately deep, permeable, moderately sloping soils have a medium-textured surface layer and a moderately fine textured subsoil.

The soils of this complex occur on slopes of small drainageways and on slopes in the north-central part of the county. The soils are used mainly as native range, but some areas are planted to grain sorghum or small grain.

Because these soils are moderately sloping, they are poorly suited to cultivated crops. They are better for permanent pasture or native range. These soils are susceptible to moderate wind erosion and severe water erosion.

A drilled small grain or sorghum crop, grown every year, will provide residue to help control wind and water

erosion. This residue is most effective when left on the surface as a mulch. The best way to control erosion and maintain soil tilth, however, is to keep these soils in permanent pasture of perennial grasses.

Terracing these soils and farming them on the contour help to control runoff and water erosion.

In years of poor rainfall, when there is not enough crop residue to control erosion, the surface can be roughened by chiseling or listing.

CAPABILITY UNIT IVe-4, DRYLAND

Amarillo fine sandy loam, 3 to 5 percent slopes, is the only soil in this capability unit. This deep, moderately sloping soil has a moderately coarse textured surface layer and a moderately fine textured subsoil.

This soil is not extensive and occurs in areas of 5 to 30 acres in the central and western parts of the county. Grain sorghum is the main crop. Some forage sorghum and cotton are also grown.

This soil is poorly suited to cultivated crops. Because of the moderate slopes, the hazard of water erosion is high. The hazard of wind erosion is moderate. The soil is only moderately fertile.

Terraced and contoured, close-growing crops help control water and wind erosion. Drilled small grain or grain sorghum produce crop residue for control of wind and water erosion. Crop residue is most effective when left on the surface.

Probably the best way to use this soil without damaging it is to keep it in permanent pasture of drilled, adapted perennial grasses.

In seasons when crop residue is sparse, chiseling or listing cultivated areas may be necessary to roughen the surface for control of wind erosion.

CAPABILITY UNIT IVe-7, DRYLAND

Amarillo loamy fine sand, 0 to 3 percent slopes, is the only soil in this capability unit. This deep, nearly level to gently sloping soil has a coarse-textured surface layer and a moderately fine textured subsoil.

This soil occurs in several areas, but is most common in the southwest part of the county. Grain sorghum and cotton are the major crops grown.

This soil is poorly suited to cultivation. Because of the sandy surface layer, the hazard of wind erosion is very high and the fertility and the water-holding capacity are problems. The hazard of water erosion is slight.

Wind and water erosion can be controlled to some extent, however, by growing grain sorghum or forage sorghum in closely spaced rows every year. A drilled, adapted perennial grass also provides cover and residue for controlling erosion. Crop residue is most effective if left on the surface throughout the year.

In years of low rainfall, crop residue may not be sufficient to control erosion, and chiseling or listing of cultivated areas may be necessary.

CAPABILITY UNIT IVe-9, DRYLAND

This capability unit consists of moderately shallow and shallow, nearly level to gently sloping soils that have a medium-textured surface layer and a moderately fine textured subsoil. The soils are—

Mansker loam, 0 to 1 percent slopes.
Mansker loam, 1 to 3 percent slopes.
Stegall-Lea loams, shallow.

These soils occur in small areas throughout the eastern and northern parts of the county. Grain sorghum, cotton, and small grains are the major crops grown.

The soils in this capability unit have a moderate water-holding capacity and moderate fertility. The hazard of water erosion is slight to moderate and that of wind erosion is moderate.

These soils are poorly suited to cultivated crops. Grain sorghum in closely spaced rows or drilled small grain, grown every year, produces residue that retains moisture and helps control wind and water erosion. Crop residue is most effective if it is left on top of the soil as a mulch at all times.

Keeping the soil in permanent pasture of adapted, perennial grass is also a good way to control erosion.

In years of low rainfall, when crop residue is insufficient to control erosion, chiseling or listing of cultivated areas may be necessary to roughen the surface.

CAPABILITY UNIT IVe-10, DRYLAND

This capability unit consists of moderately shallow and shallow, nearly level to gently sloping soils that have a moderately coarse textured surface layer and a moderately fine textured subsoil. The soils are—

Arvana fine sandy loam, shallow, 0 to 1 percent slopes.
Arvana fine sandy loam, shallow, 1 to 3 percent slopes.
Mansker fine sandy loam, 0 to 1 percent slopes.
Mansker fine sandy loam, 1 to 3 percent slopes.

These soils occur in small areas in the central and western parts of the county. They are normally used for grain sorghum or forage sorghum. The hazard of wind erosion is moderate and that of water erosion is slight. These soils are also limited by a moderate water-holding capacity and moderate fertility.

A crop of grain sorghum in closely spaced rows or a drilled small grain each year provides residue to control erosion. Leaving all residue on the surface is effective in controlling erosion.

An adapted perennial grass, planted as permanent pasture, is also effective in controlling erosion.

In years of poor rainfall, when crop residue is insufficient to control erosion, chiseling or listing of cultivated fields may be necessary to roughen the surface.

CAPABILITY UNIT IVw-1, DRYLAND

Randall fine sandy loam is the only soil in this capability unit. It is a deep, level soil with a moderately coarse textured surface layer and a fine-textured subsoil. The soil is flooded for short periods.

This soil is inextensive and occurs in areas of 5 to 30 acres in the floors of playa lakes in the southwestern part of the county. Grain sorghum and barley are the most common crops. Some areas are in permanent pasture or are idle.

This soil is fertile. Because of the periodic flooding, however, crops are harvested only in years of average or less than average rainfall.

In most places areas of this soil are so small that they are managed with adjoining areas.

CAPABILITY UNIT IVes-1, DRYLAND

This capability unit consists of shallow and moderately deep soils that are limy, permeable, and nearly level to gently sloping. These soils have a moderately coarse

or moderately fine textured surface layer and a moderately fine and fine textured subsoil. The soils are—

Arch clay loam.
Arch fine sandy loam.
Church clay loam.
Drake soils, 1 to 3 percent slopes.

These soils are most common in the north-central part of the county, but they also occur in small, scattered areas throughout the rest of the county. Grain sorghum and forage sorghum are the most common crops. Small grain and cotton are also grown.

These soils are limited in fertility and water-holding capacity by their content of lime and their relatively shallow depth. They are poorly suited to cultivated crops and are best suited to permanent pasture or native range. The hazard of wind erosion is high and that of water erosion is moderate.

A permanent pasture of drilled perennial grasses provides residue and cover for controlling erosion. Drilled grain or forage sorghum, grown every year, also provides residue and cover.

Crop residue is most effective in controlling erosion if left on the surface as a mulch.

In years of poor rainfall, when crop residue is not sufficient for erosion control, chiseling or listing of cultivated areas may be necessary to roughen the surface.

CAPABILITY UNIT VIe-3, DRYLAND

The soils in this capability unit are shallow, moderately sloping to steep, and limy. They have a medium or moderately fine textured surface layer and a moderately fine textured subsoil. The soils are—

Drake soils, 3 to 5 percent slopes.
Drake soils, 5 to 20 percent slopes.

These soils are not extensive but occur in small areas throughout the county. Although most areas are used for native range, some of the less sloping areas are used for grain sorghum.

Because these soils are moderately sloping to steep, are highly susceptible to wind and water erosion, and are relatively infertile, they are not suitable for cultivation.

These soils are best protected from erosion and deterioration if kept in permanent pasture. Blue grama, black grama, and side-oats grama are the grasses best suited. Alkali sacaton is common on the steeper slopes.

CAPABILITY UNIT VIe-6, DRYLAND

Brownfield fine sand, thick surface, is the only soil in this capability unit. It is a deep, nearly level to gently sloping soil with a coarse-textured surface layer and a moderately fine textured subsoil.

This soil occurs in only two small areas—one in the southwestern corner and the other in the north-central part of the county. It is used as native range.

This soil is subject to very severe wind erosion and has poor fertility. It has low water-holding capacity in the surface layer and is not suitable for cultivated crops.

Native range or permanent pasture of drilled, adapted perennial grasses provide residue and cover to protect the soil from wind erosion. Some of the grasses best adapted to this soil are switchgrass, little and big bluestem, and Indiangrass.

CAPABILITY UNIT VIw-1, DRYLAND

Randall clay is the only soil in this capability unit. This soil is deep, level, and poorly drained. It has a fine-textured surface layer and subsoil.

Randall clay occurs throughout the county in intermittent lakes that are 5 to 55 acres in size. These areas are used mostly for native range or permanent pasture, or they are left idle. Some areas are planted to small grain and grain sorghum, but periodic flooding and wetness make production unlikely except in years of scant rainfall. Surface drainage is possible in some of the shallow depressions, and these areas, if well drained, are suitable for crops.

CAPABILITY UNIT VIIe-1, DRYLAND

Tivoli fine sand is the only soil in this capability unit. This is a deep, undulating dune soil that has a coarse-textured surface layer and subsoil. This soil occurs in one 280-acre area in the north-central part of the county and is used as native range.

Tivoli fine sand is entirely unsuitable for cultivation. It is subject to very severe wind erosion and it has low water-holding capacity and low fertility.

Well-managed native range or permanent pasture of adapted perennial grasses provides residue and cover for control of wind erosion.

This soil can support a fair growth of big bluestem, little bluestem, Indiangrass, switchgrass, and other tall grasses.

CAPABILITY UNIT VIIs-1, DRYLAND

This capability unit consists of very shallow, nearly level to steep soils that have a moderately fine textured surface layer. The soils are—

Kimbrough soils.
Potter soils.

These soils make up only a small percentage of the county area, mostly in the north-central part. A smaller acreage is along some of the small drainageways.

These soils are entirely unsuitable for cultivation because of their very shallow root zone, low water-holding capacity, low fertility, and steep slopes.

Well-managed native range or permanent pasture of perennial grass protects these soils from excessive erosion.

The grasses best adapted are side-oats grama, blue grama, and buffalograss. These shallow soils produce good yields of the mid and short grasses.

Management of Irrigated Soils

About half of the cropland in Hockley County is irrigated, and the soils are well suited to irrigation. Managing irrigated soils, however, involves more problems than managing dryland soils. The existing hazards of wind and water erosion are compounded by the problem of applying water to the soils efficiently and without erosion. Consequently, a system must be designed for conservation irrigation.

Conservation irrigation

An irrigation system should be suited to the soil and the crop, and the water should be efficiently applied to obtain maximum yields and assure conservation of soil and water. Some of the practices needed in conservation irrigation are discussed in this subsection.

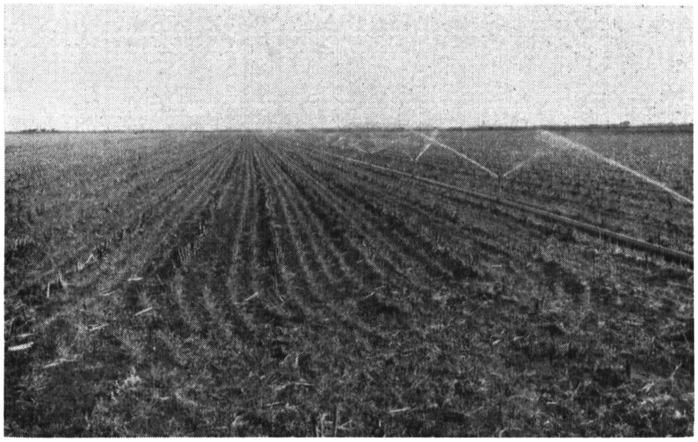

Figure 17.—**Sprinkler irrigation of drilled small grain in a field of Mansker loam, 1 to 3 percent slopes.**

In Hockley County the soils are irrigated by the sprinkler method and by surface methods. The sprinkler method can be used on all the soils, but it is best suited to coarse-textured, shallow, or rolling soils (fig. 17). Surface irrigation may be preferable on fine-textured and medium-textured soils that are 20 inches or more in depth and have nearly level, uniform slopes.

Permanent underground pipe or portable pipe can be used to carry irrigation water from the wells to the crops (fig. 18). A high-pressure transport line is required for sprinkler irrigation.

Some soil preparation may be necessary, especially for surface irrigation. *Bench leveling* is a method of preparing land in narrow borders that have a uniform grade (fig. 19). This practice is common for surface irrigation of gently sloping land. *Land leveling* is a common practice if fields are nearly level and a level furrow system is to be used.

Regardless of the method of irrigation, the design of the system is important. For surface irrigation, the amount of water applied, the time of application, and the length of the row run should be carefully planned and regulated. For sprinkler irrigation, the size of the nozzle, the distance between the sprinklers, the amount of water applied, and the time of application should be taken into account.

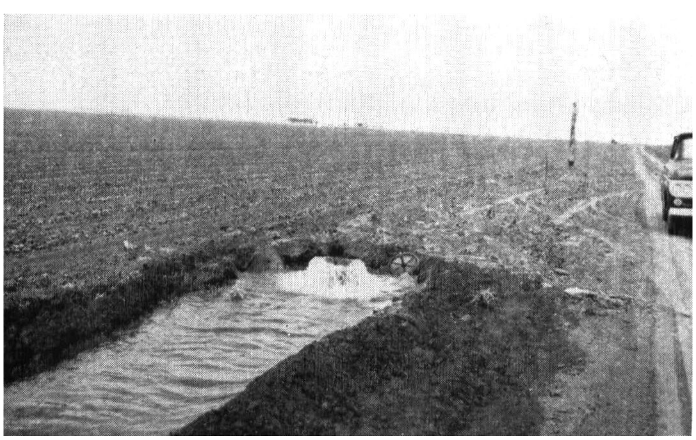

Figure 18.—**Irrigation water emerging from valve in underground water transport system. Water is pumped from irrigation well in backgound. Soil is Olton loam, 0 to 1 percent slopes.**

The Soil Conservation Service staff can assist farmers in designing irrigation systems.

Suggested practices for managing irrigated soils

Irrigated crops generally yield more than twice as much as dryland crops, but careful management is required to maintain this production. Some practices discussed under dryland farming also apply to irrigation farming.

Leaving all crop residue on the surface is an important practice in controlling erosion, conserving moisture, and maintaining soil tilth. Irrigated soils generally are not terraced unless they are sloping and are irrigated by a sprinkler system. Diversion terraces and waterways are used occasionally to intercept water and to protect an irrigated field. Emergency tillage is rarely practiced on irrigated soils, but it can be done if necessary.

Various practices are used to protect irrigated soils from wind erosion. A cover crop of small grain or vetch, seeded in a low-residue crop in fall, is commonly used for winter protection. Barnyard manure and cotton burs are also used. Stripcropping is another practice that protects the soils against wind erosion.

Figure 19.—**Bench leveling a field of Olton loam, 0 to 1 percent slopes.**

Fertilizing irrigated crops is a common practice in recent years, and yields of most crops are generally increased as a result of applying commerical fertilizer (fig. 20). Nitrogen and phosphorus are the nutrients commonly applied. The amounts and kinds of fertilizer needed can be determined by soil tests.

Cropping systems for irrigated soils differ from those for dryland soils. On irrigated soils the cropping system is not necessarily limited to cotton and grain sorghum. Many soil-improving crops besides grain sorghum can be grown on irrigated soils. Alfalfa, soybeans, cowpeas, vetch, winter peas, small grain, and native grass can be included in the cropping systems, and because these soil-improving crops produce much more residue on irrigated soils than on dryland soils, they do not have to be planted so frequently.

Figure 20.—Fertilizing a high-residue crop.

Native grass is one of the best soil-improving crops to include in a cropping system. Indiangrass, switchgrass, lovegrass, and other tall grasses, when irrigated, make excellent growth. The extensive root system of grass penetrates deeply, thereby opening and loosening the subsoil and restoring its original friability and fertility. Grass grown for a few years not only benefits the subsoil, but provides grazing and seed and abundant residue for protection from erosion (fig. 21).

All soils can be protected and improved by grass. The poorer soils might be best suited to permanent pasture, and the better soils could be improved and protected by keeping different parts of a field successively in grass for 3 or 4 years.

Capability groups for irrigation

The soils of Hockley County that are suitable for irrigation have been placed in the following capability classes, subclasses, and units.

Class II. Soils that have some limitations that reduce the choice of plants or require moderate conservation practices.

Subclass IIe. Soils subject to moderate wind or water erosion if not protected.

Unit IIe-1, irrigated.—Deep, nearly level soils that have a medium-textured surface layer and a moderately fine textured subsoil.

Figure 21.—Cows grazing irrigated grass on Olton loam, 0 to 1 percent slopes.

Unit IIe-2, irrigated.—Deep, nearly level soils that are on uplands and bottom lands and have a medium or moderately fine textured surface layer and a moderately fine textured subsoil.

Unit IIe-3, irrigated.—Moderately deep, permeable, nearly level soils that have a medium-textured surface layer and a moderately fine textured subsoil.

Unit IIe-4, irrigated.—Deep and moderately deep, nearly level soils that have a moderately coarse textured surface layer and a moderately fine textured subsoil.

Unit IIe-5, irrigated.—Moderately deep, permeable, nearly level soils that have a moderately coarse textured surface layer and a moderately fine textured subsoil.

Class III. Soils that have severe limitations that reduce the choice of plants, require special conservation, practices or both.

Subclass IIIe. Soils subject to severe water erosion and moderate or slight wind erosion if not protected.

Unit IIIe-2, irrigated.—Deep, gently sloping soils that have a moderately fine textured surface layer and subsoil.

Unit IIIe-3, irrigated.—Deep, gently sloping soils that have a medium-textured surface layer and a moderately fine textured subsoil.

Unit IIIe-4, irrigated.—Moderately deep, permeable, gently sloping soils that have a medium-textured surface layer and a moderately fine textured subsoil.

Unit IIIe-5, irrigated.—Deep and moderately deep, gently sloping soils that have a moderately coarse textured surface layer and a moderately fine textured subsoil.

Unit IIIe-6, irrigated.—Moderately deep, gently sloping, permeable soils that have a moderately coarse textured surface layer and a moderately fine textured subsoil.

Unit IIIe-8, irrigated.—Deep, nearly level to gently sloping soils that have a coarse-textured surface layer and a moderately fine textured subsoil.

Unit IIIe-10, irrigated.—Shallow, nearly level to gently sloping soils that have a moderately coarse or medium-textured surface layer and a moderately fine textured subsoil.

Subclass IIIes. Soils that are subject to severe wind erosion and have severe root zone limitations.

Unit IIIes-1, irrigated.—Shallow and moderately deep soils that are limy, permeable, and nearly level to gently sloping and have a moderately coarse, medium, or moderately fine textured surface layer and a moderately fine or fine-textured subsoil.

Class IV. Soils that have very severe limitations that restrict the choice of plants, require very careful management, or both.

Subclass IVe. Soils subject to moderate to severe wind erosion and slight to severe water erosion if not protected.

Unit IVe-2, irrigated.—Deep and moderately deep, moderately sloping soils that have a mod-

erately coarse or medium-textured surface layer and a moderately fine textured subsoil.

Unit IVe-4, irrigated.—Moderately deep, moderately sloping, limy soils that have a medium or moderately fine textured surface layer and a moderately fine textured subsoil.

Unit IVe-5, irrigated.—Deep, nearly level to gently undulating soils that have a coarse-textured surface layer and a moderately fine textured subsoil.

Management of irrigated soils by capability units

In this section each capability unit is described; the soils in it are listed, and their use and management are discussed.

CAPABILITY UNIT IIe-1, IRRIGATED

The only soil in this unit is Olton loam, 0 to 1 percent slopes. It is a deep, nearly level soil with a medium-textured surface layer and a moderately fine textured subsoil.

Most areas of this soil are in the eastern part of the county. Cotton and grain sorghum are the main crops, but small grains, vegetables, and alfalfa are grown to a minor extent.

The soil is fertile and productive when irrigated. The hazard of wind and water erosion is slight. The water intake rate is low. Maintaining soil tilth and keeping the soil open and in a favorable condition for water penetration are important.

A properly designed system of applying water and underground transport pipe will increase irrigation efficiency. This soil is suited to furrow, border, and sprinkler irrigation.

A cropping system that includes a small grain, grain sorghum, or some other high-residue crop at least one-third of the time will provide the residue needed to control erosion and maintain good tilth. An example of such a system is 1 year of cotton, 1 year of fertilized grain sorghum, and another year of cotton. A satisfactory alternative would be to plant one-third of the land to a cover crop of small grains or vetch each year.

Managing the residue so that most of it remains on the surface is helpful in controlling wind erosion and in keeping the soil in condition.

Fertilizing according to needs indicated by soil tests and the needs of the crop will help maintain yields. Yields usually decline in a few years if nitrogen and phosphorus are not applied.

CAPABILITY UNIT IIe-2, IRRIGATED

In this unit are deep, nearly level soils that are on uplands and bottom lands and have a medium-textured or moderately fine textured surface layer and a moderately fine textured subsoil. The soils are—

Amarillo loam, 0 to 1 percent slopes.
Spur and Bippus soils.
Zita loam, 0 to 1 percent slopes.

Most areas of these soils are in the eastern part of the county. The main crops grown on them are cotton and grain sorghum. Other crops are small grain, alfalfa, vegetables, and soybeans.

These fertile soils are well suited to irrigation and produce good yields. Their water-holding capacity is moderate. The hazard of wind and water erosion is slight.

Underground transport pipe and a properly designed method of applying water will increase the efficiency of irrigation on these soils. Furrow, border, and sprinkler irrigation are suitable.

A cropping system that includes grain sorghum, a small grain, or some other high-residue crop at least one-third of the time will provide residue needed to control erosion and maintain good tilth. An example of a suitable cropping system is 1 year of fertilized grain sorghum, and then 2 years of cotton.

Crop residue left on or near the surface is especially helpful in controlling wind erosion and maintaining soil tilth.

These soils should be fertilized according to soil tests and crop needs.

CAPABILITY UNIT IIe-3, IRRIGATED

Portales loam, 0 to 1 percent slopes, is the only soil in this capability unit. It is a moderately deep, permeable, nearly level soil with a medium-textured surface layer and a moderately fine textured subsoil.

The irrigated acreage of this soil makes up about 3 percent of the county. It is most common in the eastern part of the county but is also in small, scattered areas elsewhere. Cotton and grain sorghum are the most important crops, but small grains and forage sorghum are also grown.

This soil is moderately fertile and has a moderate water-holding capacity. It can be irrigated successfully, but it requires good management and a well-designed irrigation system. The hazard of wind and water erosion is slight.

A properly designed method of applying water and underground pipe for transporting it will increase the efficiency of irrigation on this permeable soil. Furrow, border, and sprinkler irrigation are suitable.

The residue necessary to control erosion and maintain good tilth can be provided by a cropping system that includes grain sorghum, a small grain, or some other high-residue crop at least one-third of the time. A satisfactory cropping system is a year of cotton, a year of fertilized grain sorghum, and another year of cotton.

Managing crop residue so that most of it is left on or near the surface also helps to control wind erosion and maintain soil tilth.

This soil should be fertilized according to soil tests and needs of the crop. Yields usually decline in a few years if nitrogen and phosphorus are not applied.

CAPABILITY UNIT IIe-4, IRRIGATED

This capability unit consists of deep and moderately deep, nearly level soils that have a moderately coarse textured surface layer and a moderately fine textured subsoil. The soils are—

Amarillo fine sandy loam, 0 to 1 percent slopes.
Arvana fine sandy loam, 0 to 1 percent slopes.
Zita fine sandy loam, 0 to 1 percent slopes.

These irrigated soils comprise about 20 percent of the county area and are most common in the central and western parts. Cotton and grain sorghum are the most important crops. Other crops are alfalfa, soybeans, vegetables, and forage sorghum.

These soils are well suited to irrigation and produce good yields. The water-holding capacity and fertility of these soils are moderate. The hazard of wind erosion is moderate and that of water erosion is slight.

These soils can be most efficiently irrigated by a system with underground transport pipe. Furrow, sprinkler, and border irrigation are suitable.

A cropping system that includes grain sorghum, a small grain, or some other high-residue crop at least one-third of the time provides residue for erosion control and soil maintenance. An example of a suitable cropping system is a year of cotton, a year of fertilized grain sorghum, and another year of cotton. A suitable alternative would be a cover crop of small grain or vetch on one-third of the land each year.

Crop residue controls wind erosion and maintains soil tilth most effectively if left on the surface.

Fertilizer should be applied according to soil tests and crop needs.

CAPABILITY UNIT IIe-5, IRRIGATED

Portales fine sandy loam, 0 to 1 percent slopes, is the only soil in this capability unit. This soil is permeable, moderately deep, and nearly level. It has a moderately coarse textured surface layer and a moderately fine textured subsoil.

This soil occurs in many small areas in the central and western parts of the county. Cotton and grain sorghum are the most common crops.

This soil can be irrigated successfully, but it is permeable. Therefore, good management and a suitable irrigation system are needed. The soil is only moderately fertile. The hazard of wind and water erosion is moderate.

A properly designed system with underground transport pipe is essential for efficient irrigation of this soil. Furrow, border, and sprinkler irrigation are suitable.

A cropping system that includes grain sorghum, a small grain, or some other high-residue crop at least one-third of the time provides residue for erosion control and soil maintenance. An example of a suitable system is a year of cotton, a year of fertilized grain sorghum, and another year of cotton.

Wind erosion can be controlled most effectively if all plant residue is left on or near the surface.

CAPABILITY UNIT IIIe-2, IRRIGATED

Bippus clay loam, 1 to 3 percent slopes, is the only soil in this capability unit. It is a deep, gently sloping soil with a moderately fine textured surface layer and subsoil.

This inextensive soil is in the north-central part of the county and is used mostly for native range, although a few acres are used for grain sorghum.

If this soil is well managed, it is suitable for irrigated grain sorghum and cotton. Wind and water erosion are moderate hazards, and maintaining productivity and organic matter is difficult.

Underground transport pipe is necessary for efficient irrigation. The sprinkler system is best suited to this soil, but the border system can be used.

A cropping system that includes grain sorghum, a small grain, or some other high-residue crop at least half the time provides residue for erosion control and soil maintenance. An example of a suitable system is a year of grain sorghum and a year of cotton. A small grain can be substituted for the grain sorghum, or a small grain or vetch cover crop can be planted on half of the land each year.

Crop residue controls erosion most effectively if left on or near the soil surface at all times.

CAPABILITY UNIT IIIe-3, IRRIGATED

Amarillo loam, 1 to 3 percent slopes, is the only soil in this capability unit. It is a deep, gently sloping soil and has a medium-textured surface layer and a moderately fine textured subsoil.

This soil is in the eastern part of the county. Grain sorghum is the main crop, but some small grain and cotton are also grown.

This soil is fertile and, if well managed, is productive. Supplying irrigation water without eroding the soil is the greatest problem. Wind erosion is a moderate hazard, and maintaining productivity is difficult.

Underground transport pipe is necessary for efficient use of irrigation water and control of erosion. Sprinkler or border systems are suitable for this soil.

A cropping system that includes grain sorghum, a small grain, or some other high-residue crop at least half the time provides residue for erosion control and soil maintenance. A suitable system is a year of grain sorghum and a year of cotton. As an alternative, a cover crop of small grain or vetch can be planted on half of the land each year.

Erosion can be controlled most effectively if all the crop residue is left on or near the surface at all times.

CAPABILITY UNIT IIIe-4, IRRIGATED

Portales loam, 1 to 3 percent slopes, the only soil in this capability unit, is moderately deep, permeable, and gently sloping. It has a medium-textured surface layer and a moderately fine textured subsoil.

This soil is in small areas throughout the county but is most common in the eastern part. Grain sorghum is the principal crop. Some forage sorghum, small grain, and cotton are also grown.

This soil is permeable and gently sloping. Maintaining productivity and irrigating the soil without causing erosion are management problems. Wind erosion and water erosion are moderate hazards on this soil.

A well-designed system is required to irrigate this soil efficiently. Sprinkler or border irrigation is suitable.

A cropping system that includes grain sorghum, a small grain, or some other high-residue crop at least half the time provides residue for controlling erosion and maintaining tilth. An example of a suitable system is a year of fertilized grain sorghum and a year of cotton. Small grain can be substituted for the grain sorghum, or a cover crop of vetch or small grain can be planted on half the land each year.

Crop residue left on or near the surface protects the soil from wind and water and maintains tilth and fertility.

CAPABILITY UNIT IIIe-5, IRRIGATED

This capability unit consists of deep and moderately deep, gently sloping soils that have a moderately coarse textured surface layer and a moderately fine textured subsoil. The soils are—

Amarillo fine sandy loam, 1 to 3 percent slopes.
Arvana fine sandy loam, 1 to 3 percent slopes.

Most areas of these soils are in the central and western parts of the county. Grain sorghum is the main crop, although cotton is also grown.

The main problems in managing these soils are irrigating them without eroding them and maintaining organic matter and fertility. The hazard of wind and water erosion is moderate.

A properly designed system with underground transport pipe is necessary to irrigate these soils efficiently. Border or sprinkler irrigation is suitable.

A cropping system that includes a small grain, grain sorghum, or some other high-residue crop at least half the time provides residue for controlling erosion and maintaining tilth. An example of a suitable system is a year of fertilized grain sorghum and a year of cotton. An alternative system would be a small grain or grain sorghum each year or a cover crop of small grain planted on half the land each year.

Crop residue is most effective in controlling erosion and replacing organic matter if left on or near the surface.

CAPABILITY UNIT IIIe-6, IRRIGATED

Portales fine sandy loam, 1 to 3 percent slopes, is the only soil in this capability unit. This soil is moderately deep, gently sloping, and permeable. It has a moderately coarse textured surface layer and a fine-textured subsoil.

This soil is in areas of 10 to 300 acres in the central, western, and north-central parts of the county. Grain sorghum is the principal crop.

This soil is moderately fertile and can be irrigated successfully if well managed. Because the soil is permeable, gently sloping, and likely to erode, it is difficult to irrigate. The hazard of wind and water erosion is moderate on this soil.

Underground transport pipe is essential to irrigate this soil. Border or sprinkler irrigation is suitable.

A cropping system that includes grain sorghum, a small grain, or some other high-residue crop at least half the time provides residue for controlling erosion and maintaining tilth. An example of such a system is a year of grain sorghum and a year of cotton. Cotton may be grown every year if a cover crop of small grain or vetch is planted in alternate years to provide winter cover.

Crop residue controls erosion most effectively if left on or near the surface to protect the soil.

CAPABILITY UNIT IIIe-8, IRRIGATED

Amarillo loamy fine sand, 0 to 3 percent slopes, is the only soil in this capability unit. It is deep and nearly level to gently sloping and has a coarse-textured surface layer and a moderately fine textured subsoil.

This soil is most common in the southwestern part of the county. Grain sorghum is the main crop. Some areas are in native range.

This soil has a low water-holding capacity and low fertility, and because of the sandy surface layer, it has a high rate of initial water intake. The hazard of wind erosion is high.

A sprinkler system with underground transport pipe is the most efficient method of irrigating this soil.

A cropping system that includes grain sorghum, a small grain, or some other high-residue crop at least two-thirds of the time provides residue for controlling erosion and maintaining tilth. An example of such a system is a year of fertilized grain sorghum that has been drilled or planted in closely spaced rows, a year of cotton, and another year of fertilized, drilled grain sorghum. An alternative system consists of a cover crop grown with the cotton each year. Permanent pasture of adapted native grasses is also an excellent use for this soil.

If the sandy surface layer of this soil is not thicker than 14 inches, deep plowing will bring some of the moderately fine textured subsoil to the surface to form clods that resist wind erosion. Leaving crop residue on the surface also helps to control wind erosion.

Fertilizer should be applied according to soil tests and crop needs. This soil responds well to commercial fertilizer.

CAPABILITY UNIT IIIe-10, IRRIGATED

This capability unit consists of moderately shallow and shallow, nearly level to gently sloping soils that have a moderately coarse textured or medium-textured surface layer and a moderately fine textured subsoil. The soils are—

Arvana fine sandy loam, shallow, 0 to 1 percent slopes.
Arvana fine sandy loam, shallow, 1 to 3 percent slopes.
Mansker fine sandy loam, 0 to 1 percent slopes.
Mansker fine sandy loam, 1 to 3 percent slopes.
Mansker loam, 0 to 1 percent slopes.
Mansker loam, 1 to 3 percent slopes.
Stegall-Lea loams, shallow.

These soils are most common in the northwestern part of the county, but small areas of the Mansker soils may occur elsewhere. Cotton and grain sorghum are the main crops grown.

These soils have a restricted root zone, low water-holding capacity, and low fertility. The shallow depth also limits tillage. The hazard of wind erosion is moderate and that of water erosion is slight. These soils hold less water than deeper soils and must be irrigated more frequently.

Sprinkler irrigation with underground transport pipe is best for these soils.

A cropping system that includes grain sorghum, a small grain, or some other high-residue crop at least two-thirds of the time provides residue for controlling erosion and maintaining tilth. An example of a suitable system is a year of cotton and 2 years of fertilized grain sorghum. A cover crop of small grain or vetch can be seeded in the cotton each year as an alternative system. All adapted perennial grasses in permanent pasture also provide sufficient residue.

Crop residue best controls erosion and maintains soil tilth if left on the surface.

CAPABILITY UNIT IIIes-1, IRRIGATED

This capability unit consists of shallow and moderately deep soils that are limy, permeable, and nearly level to gently sloping. These soils have a moderately coarse textured, medium-textured, or moderately fine textured surface layer and a moderately fine textured or fine-textured subsoil. The soils are—

Arch clay loam.
Arch fine sandy loam.
Church clay loam.
Drake soils, 1 to 3 percent slopes.

Most areas of these soils are in the north-central and northwestern parts of the county, but small areas also occur in the rest of the county. Grain sorghum is the most important crop. The soils are also used for pasture and native range.

The soils of this unit are relatively poor for irrigated crops. As they are limy, the soils are subject to severe wind erosion. They are also subject to moderate water erosion.

These soils have limited water-holding capacity because they are permeable and shallow. Therefore, they must be irrigated more frequently than deeper soils. Furthermore, plant food is tied up by the lime in these soils.

Underground transport pipe is necessary for irrigating these soils. Border or sprinkler irrigation is suitable.

A cropping system that includes grain sorghum, a small grain, or some other high-residue crop at least two-thirds of the time provides residue for controlling erosion and maintaining tilth. An example of a suitable system is a year of grain sorghum, a year of cotton, and another year of grain sorghum. Permanent pasture of adapted perennial grasses is a good alternative use of these soils.

Leaving all crop residue on or near the surface helps control erosion.

CAPABILITY UNIT IVe-2, IRRIGATED

This capability unit consists of deep and moderately deep, moderately sloping soils that have a moderately coarse textured or medium-textured surface layer and a moderately fine textured subsoil. The soils are—

Amarillo fine sandy loam, 3 to 5 percent slopes.
Berthoud-Mansker loams, 3 to 5 percent slopes.

These inextensive soils are most common in the north-central part of the county. They are used mainly for grain sorghum and permanent pasture.

A high susceptibility to water erosion is the main problem in managing these soils. Special care is needed to irrigate them efficiently and control erosion. Sprinkler irrigation is the most suitable method. These soils are also subject to moderate wind erosion. They are moderately fertile, however, and have moderate water-holding capacity.

Because of the severe erosion hazard, the soils should be used only for high-residue crops. A fertilized grain sorghum or forage sorghum crop, grown every year in closely spaced rows, will provide sufficient residue for erosion control. A fertilized, drilled small grain, grown every year, also provides cover and residue to control erosion. The best use for these soils, however, is permanent pasture of adapted perennial grasses.

All crop residue should be left on or near the surface to control erosion.

CAPABILITY UNIT IVe-4, IRRIGATED

Drake soils, 3 to 5 percent slopes, are the only soils in this capability unit. These soils are shallow, limy, and moderately sloping. They have a medium-textured or moderately fine textured surface layer and subsoil.

Only a small acreage is irrigated. A few small areas are planted to grain sorghum or permanent pasture.

Because these soils are limy and moderately sloping, they are highly susceptible to wind and water erosion. Also, they have only a moderate water-storage capacity, and the excess lime ties up plant food.

A sprinkler system is best for irrigating these soils.

The severe erosion hazard limits the choice of crops to those that produce much residue. Sufficient residue for erosion control can be provided by growing every year a fertilized grain sorghum or forage sorghum in closely spaced rows. A fertilized, drilled small-grain crop, grown every year, also provides sufficient residue. The best use for these soils, however, is permanent pasture of adapted perennial grasses.

Erosion can be controlled most effectively if all crop residue is left on the surface.

CAPABILITY UNIT IVe-5, IRRIGATED

Brownfield fine sand, thick surface, is the only soil in this capability unit. This soil is deep and nearly level to gently undulating. It has a coarse-textured surface layer and a moderately fine textured subsoil.

All of this inextensive soil is used as native range.

Because of the thick surface layer of fine sand, this soil is subject to severe wind erosion. The surface layer is underlain by a relatively infertile sandy clay loam subsoil. Therefore, it is generally impractical to increase the clay content of the surface layer by deep tillage.

Sprinkler irrigation is the best system for this soil.

Because of the high erosion hazard, crops are limited to those that produce much residue. Sufficient residue can be produced by growing annually a fertilized grain sorghum or forage sorghum crop in closely spaced rows. A fertilized, drilled small grain, grown every year, is also suitable. The best use for this soil, however, is permanent pasture of adapted perennial grasses.

Erosion can be controlled most effectively if all crop residue is left on the surface.

Yields of Crops

Crop yields over a period of years reflect the management of soil. Generally, continued high yields are a result of good management and an indication that the soil has been improved or is being kept in good condition.

The predicted average yields per acre of principal crops grown under two levels of management on dryland and irrigated soils are shown in table 2. Yields expected under a low level of management are in columns *A*, and yields expected under a high level of management are in columns *B*.

Under a low level of management, the following practices are used on dryland:

1. Wind erosion is controlled by tillage alone.
2. No special effort is made to conserve water.
3. Soil-improving crops are not used regularly in a cropping system.

Under a low level of management, the following practices are used on irrigated soils:

1. No effort is made to conserve rainfall.
2. Crop residue is plowed under, removed, or destroyed.
3. Crops are irrigated erratically with little regard for crop needs.
4. Fertilizer is not used or is used in a haphazard way.

Under a high level of management, the following practices are used on dryland:

1. Moisture is saved.
2. Crop residue is used to control wind erosion.
3. Soil fertility is improved, and high-residue crops are grown regularly in the system.

Under a high level of management, the following practices are used on irrigated soils:

1. A conservation irrigation system is used to make the best use of all rainfall and to supply water according to crop needs.

TABLE 2.--PREDICTED AVERAGE ACRE YIELDS OF PRINCIPAL CROPS ON DRYLAND AND IRRIGATED SOILS UNDER TWO LEVELS OF MANAGEMENT

[Yields in columns A are expected under a low level of management; those in columns B are expected under a high level of management. Absence of figures indicates crop is not suited to, or is not grown on, the soil]

Soil	Cotton (lint)				Grain sorghum			
	Dryland soils		Irrigated soils		Dryland soils		Irrigated soils	
	A	B	A	B	A	B	A	B
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Amarillo fine sandy loam, 0 to 1 percent slopes	150	170	550	850	800	1,100	3,000	5,000
Amarillo fine sandy loam, 1 to 3 percent slopes	125	150	475	700	700	850	2,250	4,500
Amarillo fine sandy loam, 3 to 5 percent slopes	75	---	300	---	500	600	1,200	3,000
Amarillo loam, 0 to 1 percent slopes	140	170	550	850	800	1,000	3,000	5,000
Amarillo loam, 1 to 3 percent slopes	125	150	475	700	700	850	2,500	4,500
Amarillo loamy fine sand, 0 to 3 percent slopes	130	---	475	700	750	850	2,000	4,500
Arch clay loam	80	---	350	450	400	550	1,500	2,000
Arch fine sandy loam	80	---	350	450	400	550	1,500	2,000
Arvana fine sandy loam, 0 to 1 percent slopes	140	165	480	700	750	1,000	2,500	4,500
Arvana fine sandy loam, 1 to 3 percent slopes	120	140	420	590	650	900	2,000	4,000
Arvana fine sandy loam, shallow, 0 to 1 percent slopes	75	---	375	450	500	650	1,800	2,500
Arvana fine sandy loam, shallow, 1 to 3 percent slopes	70	---	300	375	400	525	1,500	2,200
Berthoud-Mansker loams, 3 to 5 percent slopes	75	---	300	---	400	525	1,300	1,900
Bippus clay loam, 1 to 3 percent slopes	125	150	425	550	650	750	2,000	4,000
Brownfield fine sand, thick surface	80	---	300	---	500	-----	1,000	3,000
Church clay loam	70	---	400	475	400	500	2,000	2,500
Drake soils, 1 to 3 percent slopes	75	---	375	475	500	600	1,200	2,000
Drake soils, 3 to 5 percent slopes	60	---	300	---	400	-----	900	1,200
Drake soils, 5 to 20 percent slopes	---	---	---	---	---	-----	-----	-----
Kimbrough soils	---	---	---	---	---	-----	-----	-----
Mansker fine sandy loam, 0 to 1 percent slopes	100	---	300	450	500	700	1,800	3,000
Mansker fine sandy loam, 1 to 3 percent slopes	90	---	300	400	450	500	1,500	2,500
Mansker loam, 0 to 1 percent slopes	100	---	300	450	500	700	1,700	2,500
Mansker loam, 1 to 3 percent slopes	90	---	250	400	400	500	1,200	1,900
Olton loam, 0 to 1 percent slopes	140	165	550	750	700	1,000	4,000	6,000
Portales fine sandy loam, 0 to 1 percent slopes	140	160	500	700	800	1,000	2,800	4,700
Portales fine sandy loam, 1 to 3 percent slopes	130	150	400	550	700	800	2,500	4,500
Portales loam, 0 to 1 percent slopes	140	165	500	625	700	800	2,500	5,000
Portales loam, 1 to 3 percent slopes	125	150	425	550	650	750	2,000	4,500
Potter soils	---	---	---	---	---	-----	-----	-----
Randall clay	---	---	---	---	---	-----	-----	-----
Randall fine sandy loam	100	---	500	---	700	1,000	2,000	4,000
Spur and Bippus soils	150	160	550	850	800	1,100	3,000	5,000
Stegall-Lea loams, shallow	75	---	375	450	500	650	1,800	2,200
Tivoli fine sand	---	---	---	---	---	-----	-----	-----
Zita fine sandy loam, 0 to 1 percent slopes	150	170	500	725	800	1,100	3,000	5,000
Zita loam, 0 to 1 percent slopes	140	170	500	725	800	1,000	3,000	5,000

2. Fertilizer is used in amounts determined by soil tests and crop needs.
3. Crop residue is used to help control wind and water erosion.
4. Soil fertility is improved, and high-residue crops are included in the cropping system.
5. Improved methods of farming and improved varieties of crops are used to increase crop production.

Almost all farmers in Hockley County practice a high level of weed, plant disease, and insect control.

Range Management[1]

Nineteen percent of the county, or about 110,000 acres, still remains in native grass. This includes six ranching units that range in size from 1,600 to 60,000 acres. In addition, there are 12 to 15 livestock farming units that have native grass pastures.

Nearly all ranchers and livestock farmers are in the cow-calf business, producing calves to be marketed at weaning time. There is some supplemental feeding of farm forage and grain crops. Also, there is a small amount of "finished" feeding. On 40 to 50 farm units, some pastures are irrigated.

Livestock production is secondary to the production of cotton and grain sorghum in Hockley County, but there is a good potential for increasing the production of livestock in a well-balanced agriculture in the county.

Irrigated pastures are being developed (fig. 22), and these productive pastures are still another means of supplying feed for the cattle industry.

Most of the native grassland is in the southern and western parts of the county where most of the soils are moderately coarse and coarse textured. Short and mid grasses are on the mixed lands, and mid and tall grasses are on the sands.

The rest of the grassland is in the northern and eastern parts of the county where the soils are moderately fine textured and produce short grasses, mostly blue grama and buffalograss, when the site is in good condition.

Range sites and range condition classes

Range sites are kinds of rangeland that differ in their capacity to produce native plants. Those within a given climate differ only in the kind or amount of vegetation they can produce. These differences are a result of differences in soil depth, texture, structure, position, and, to a lesser extent, exposure and elevation.

The kind and amount of vegetation produced on a site depend on the soil, the fertility level, the soil air, and the amount of water taken in and retained in the profile. A deep, fertile, bottom-land range site that receives floodwater in addition to the normal rainfall produces taller grasses and greater amounts than an upland site or a shallow site that receives less water.

Grass, like all other green plants, manufactures its food in the green leaves and tender stems. Thus, the continued growth of range plants depends on how they are grazed.

[1] By Joe B. Norris, range conservationist, Soil Conservation Service, Lubbock, Texas.

***Figure 22.*—Irrigated Indiangrass 1 year old, planted for grazing on Olton loam, 0 to 1 percent slopes.**

Heavy grazing, or overuse, reduces, or destroys the leaf and stem surface and consequently reduces the food for plant maintenance and growth. This process, if continued year after year, kills many plants. If grazing is uncontrolled, the most palatable and nutritious plants are grazed first and thereby damaged or destroyed first. These plants are known to decrease under grazing and are called *decreasers.*

As the decreasers are eliminated, the stand is thinned, and room is made for other plants to move in. Those plants that were not grazed first occupy the area left bare when the decreasers were destroyed. These plants are known to increase with grazing and are called *increasers.*

As this process continues, the successively less desirable plants dominate the site. When the decreasers and increasers are eliminated, plants from other sites or areas much farther away invade the site. These plants are known as *invaders.*

Thus, if a range site is overgrazed continuously, the composition of the vegetation changes from the best to the poorest. These successive changes are identified as range condition classes. The range condition is *excellent* if the percentage of the original, or climax, plants is more than 75. It is *good* if the percentage is from 50 to 75, *fair* if the percentage is 25 to 50, and *poor* if the percentage is less than 25.

Descriptions and uses of range sites

Range sites are easily recognized and have distinguishing characteristics. Therefore, they are the most significant basis for rangeland management. Each site is affected by climate and the amount of grazing it receives. How the site is affected depends on the grazing habits of the various types of livestock and the palatability of the forage growing on the site. Therefore, range management requires a knowledge of (1) the range site, (2) the effect of grazing on it, and (3) the proper control of grazing.

Generally, there are several range sites in a pasture, but the livestock usually prefer one site. This site can be used as a basis for managing the entire pasture. If this area is correctly grazed, the rest of the pasture can be improved or maintained.

When in good to excellent condition, all range sites in the county, except the Sandy Land and Deep Sand, are suitable for use all year or any season of the year. Consequently, the sites are often overused and the range deteriorates.

All ranges in the county respond to the basic principles of range management, namely (1) the proper amount of grazing for plant maintenance; (2) grazing by the kind of livestock best suited to the range; (3) the necessary seasonal adjustments in grazing to make the best use of seasonally palatable plants and to prevent overuse of any part of the range; and (4) distribution of livestock over the range to assure uniform grazing.

It may be necessary to supplement these practices with others, such as deferred grazing, brush control, water control, and, in the most severe conditions, range seeding.

In Hockley County the rangeland has been classified by grouping the soils in eight range sites. The Randall soils are placed in the range site of the surrounding soils. Descriptions of the range sites follow.

BOTTOM LAND SITE

The bottoms of gently sloping draws make up this range site. These areas are flat to concave and receive extra water from adjoining slopes, from infrequent flooding, and possibly from a high water table. The only soil in this site is the Spur soil in the undifferentiated mapping unit, Spur and Bippus soils. The Bippus soil is in the Deep Hardland range site. Field inspection of the Spur soil will be needed to identify the Bottom Land site on soil maps.

This high-producing site supports such decreaser grasses as side-oats grama and little bluestem, as well as smaller amounts of switchgrass and sand bluestem. The increasers are blue grama, vine-mesquite, western wheatgrass, and alkali sacaton. The invaders are inland saltgrass, buffalograss, sand dropseed, mesquite, and annuals.

This site generally occurs inextensively in each operating unit, but it is usually the most productive part of the pasture.

Preliminary data indicate that the potential herbage yield of this site varies from approximately 3,650 pounds per acre in favorable years to 3,000 pounds in unfavorable years.

DEEP HARDLAND SITE

Level to gently sloping plains interspersed with playa lake basins make up this range site. The soils are—

Amarillo loam, 0 to 1 percent slopes.
Amarillo loam, 1 to 3 percent slopes.
Bippus clay loam, 1 to 3 percent slopes.
Olton loam, 0 to 1 percent slopes.
Bippus soil (in the Spur and Bippus soils mapping unit).
Stegall-Lea loams, shallow.
Zita loam, 0 to 1 percent slopes.

These soils have high fertility and a high water-holding capacity, but they absorb water slowly. As only short grasses can exist on a small water supply, blue grama is the dominant decreaser. Side-oats grama, vine-mesquite, western wheatgrass, and other mid grasses grow in areas that receive extra water from runoff. Buffalograss is the main increaser. The invaders are sand muhly, mesquite, and annual weeds.

Overused stands of grass are often pitted or chiseled to stimulate growth. The best practice, however, is to maintain a healthy stand of grass at all times by grazing it properly (fig. 23). Water held by the small, scattered basins sometimes gives the grass an extra chance for survival. Improvement in a range site is indicated by the increase in blue grama and the decrease in weeds.

Preliminary data indicate that the potential herbage yield of this site ranges from approximately 2,800 pounds per acre in favorable years to 1,700 pounds in unfavorable years.

MIXED PLAINS SITE

This range site is on flat to gently sloping plains and generally lies next to draws or natural depressions. The soils of these plains are susceptible to severe erosion if the plant cover is sparse. They are highly calcareous, crumbly, and permeable. The soils are—

Mansker fine sandy loam, 0 to 1 percent slopes.
Mansker fine sandy loam, 1 to 3 percent slopes.
Mansker loam, 0 to 1 percent slopes.
Mansker loam, 1 to 3 percent slopes.
Portales fine sandy loam, 0 to 1 percent slopes.
Portales fine sandy loam, 1 to 3 percent slopes.
Portales loam, 0 to 1 percent slopes.
Portales loam, 1 to 3 percent slopes.
Berthoud-Mansker loams, 3 to 5 percent slopes.

Included in the climax vegetation are such decreasers as side-oats grama, blue grama, vine-mesquite, Arizona cottontop, and needle-and-thread. Increasers in the climax vegetation are buffalograss, hairy grama, and black grama. Invaders include three-awn, sand dropseed, sand muhly, catclaw, broom snakeweed, and annuals.

This site is productive, but under continued heavy grazing, the vegetation degenerates to buffalograss. Nevertheless, this site responds favorably to good range management, and particularly if there are desirable grasses on it to furnish seed.

Preliminary data indicate that potential herbage yield of this site ranges from approximately 3,200 pounds per acre in favorable years to 2,400 pounds in unfavorable years.

MIXED LAND SITE

This site consists of level to gently sloping plains interspersed with playa lakes. The slopes range from 0 to 8 percent. Most of them are less than 5 percent, and they

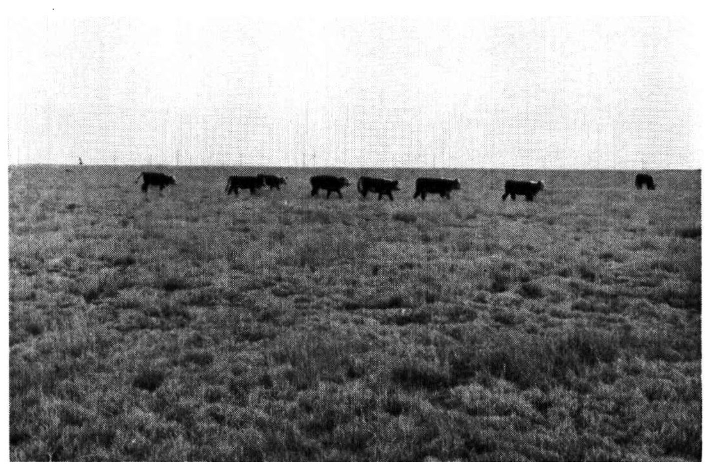

Figure 23.—**Cattle grazing Deep Hardland range site on Olton loam, 0 to 1 percent slopes. This range is in excellent condition.**

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grade toward the playa lakes or shallow draws. The soils are—

Amarillo fine sandy loam, 0 to 1 percent slopes.
Amarillo fine sandy loam, 1 to 3 percent slopes.
Amarillo fine sandy loam, 3 to 5 percent slopes.
Arvana fine sandy loam, 0 to 1 percent slopes.
Arvana fine sandy loam, 1 to 3 percent slopes.
Arvana fine sandy loam, shallow, 0 to 1 percent slopes.
Arvana fine sandy loam, shallow, 1 to 3 percent slopes.
Zita fine sandy loam, 0 to 1 percent slopes.

The climax grasses on this mid-grass site include such decreasers as blue grama, side-oats grama, Arizona cottontop, and plains bristlegrass. The increasers are buffalograss, hooded windmillgrass, sand dropseed, and silver bluestem. Common invaders are hairy tridens, broom snakeweed, catclaw, mesquite, and all annuals.

Overgrazing has destroyed the original mixture of grasses in many areas. Buffalograss is dominant on a large percentage of this site. Generally, a satisfactory source of seed is still available on the site. If the range is well managed, this source will spread, and the site will improve.

Preliminary data indicate that the potential herbage yield of this site ranges from about 3,000 pounds per acre in favorable years to 2,100 pounds in unfavorable years.

SANDY LAND SITE

Amarillo loamy fine sand, 0 to 3 percent slopes, is the only soil in this range site. This undulating soil has little or no defined drainage pattern and no long distinct slopes. Unless this soil has good ground cover, the hazard of wind erosion is high.

A good variety of climax grasses grow on this site. Included among the decreasers are Indiangrass, switchgrass, sand bluestem, little bluestem, sand lovegrass, side-oats grama, New Mexico feathergrass, and needle-and-thread. The increasers are giant dropseed, sand dropseed, blue grama, hairy grama, silver bluestem, perennial three-awn, hooded windmillgrass, sandpaspalum, and fall witchgrass. The more common invaders are gummy lovegrass, tumblegrass, red lovegrass, tumble lovegrass, tumble windmillgrass, fringed signalgrass yucca, sand sagebrush, skunkbush, shin oak, groundsel, queens-delight, western ragweed, and many annuals.

Shin oak has spread rapidly from the original motts. Sand sagebrush and skunkbush spread fairly rapidly when the adapted grasses are heavily grazed.

When this site is producing climax forage, it should be grazed in spring and summer, because the tall grasses are less palatable and less nutritive during winter. Also, this sandy site is highly susceptible to wind erosion and should be kept under a protective cover at all times.

SHALLOW LAND SITE

This range site consists of nearly level to steeply sloping soils, mostly on the rims of basins or draws or above escarpments. The soils have low water-holding capacity and are very shallow. Gravel and small rocks are embedded in the surface and throughout the profile. The soils are—

Kimbrough soils.
Potter soils.

The climax decreasers are dominantly side-oats grama, blue grama, and little bluestem, but sand bluestem, switchgrass, Canada wildrye, and New Mexico feathergrass also grow where moisture is more favorable. The increasers are buffalograss, black grama, hairy grama, sand dropseed, and perennial three-awn. The invaders are hairy tridens, red grama, sand muhly, broom snakeweed, mesquite, and annuals.

This site supports a good variety of grasses, but yields are limited by the shallow depth and the consequent low water-holding capacity of the soil.

When the soils are bare of vegetation, broom snakeweed readily invades. In most areas, this noxious plant must be controlled by spraying.

Preliminary data indicate that the potential herbage yield of this site ranges from 2,600 pounds per acre in favorable years to 1,800 pounds per acre in unfavorable years.

DEEP SAND SITE

This range site is rolling to hilly. In many areas the dunes have the appearance of bands of low hills, and in some areas they occur throughout the rolling landscape. Drainage patterns are poorly defined or nonexistent. The soils are very deep sands that have a high rate of water intake. They are highly susceptible to wind erosion. Blow-outs are active where vegetation is sparse. The soils are—

Brownfield fine sand, thick surface.
Tivoli fine sand.

The climax decreaser grasses on this site are mainly Indiangrass, sand bluestem, switchgrass, sand lovegrass, big sandreed, New Mexico feathergrass, side-oats grama, and little bluestem. The important increasers are hairy grama, blue grama, silver bluestem, hooded windmillgrass, and perennial three-awn. Included among the invaders are gummy lovegrass, tumble lovegrass, tumblegrass, red lovegrass, tumble windmillgrass, and fringed signalgrass. Other invaders are yucca, sand sagebrush, skunkbush, groundsel, western ragweed, shin oak, and many annuals. Shin oak occurs in small motts in the climax vegetation. As the grass cover decreases with heavy grazing, these motts spread rapidly.

When this site is producing climax forage, it should be grazed in spring and summer, because the tall grasses are less palatable and less nutritive during the winter. Also, this sandy site is highly susceptible to wind erosion and should be kept under a protective cover at all times.

Preliminary data indicate that the potential herbage yield of the site ranges from 3,000 pounds per acre in favorable years to 2,200 pounds in unfavorable years.

HIGH LIME SITE

The soils of this site are on the east side of playa lakes and may occur as large, sloping dunes or as flats adjoining the lakes. These immature soils have formed from highly calcareous parent material and contain a large amount of free lime. If unprotected by plant cover, these soils are subject to severe wind erosion. The slopes are also subject to severe water erosion. The soils are—

Arch clay loam.
Arch fine sandy loam.
Church clay loam.
Drake soils, 1 to 3 percent slopes.
Drake soils, 3 to 5 percent slopes.
Drake soils, 5 to 20 percent slopes.

The climax decreasers are mainly blue grama, vine mesquite, and side-oats grama. The increasers include buffalograss, black grama, and alkali sacaton. The in-

vaders are inland saltgrass, sand muhly, mesquite, and all annuals.

Preliminary data indicate that the potential herbage yield of this site ranges from 2,900 pounds per acre in favorable years to 1,700 pounds in unfavorable years.

Engineering Uses of Soils [2]

The information in this section can be used in making estimates and in planning construction. It will not, however, eliminate the need for sampling and testing of soils for the design and construction of specific engineering works.

Information in this report can be used to:

1. Make soil and land use studies that will aid in the selection and development of industrial, business, residential, and recreational sites.
2. Make preliminary estimates of soil properties that are significant in the planning of terraces, waterways, irrigation systems, and other soil and water conservation structures.
3. Make preliminary evaluations of soil and ground conditions that will aid in selecting locations for highways, airports, and pipelines.
4. Locate sources of topsoil and other construction material.
5. Correlate performance of engineering structures with soil mapping units and thus develop information that will be useful in designing and maintaining the structures.
6. Determine the suitability of soils for the cross-country movement of vehicles and construction equipment.
7. Supplement information from other published maps, reports, and aerial photographs to make maps and reports that can be used readily by engineers.
8. Develop other preliminary estimates for construction purposes in the particular area.

Some soil science terms used in this section may have a different meaning in engineering or may be unfamiliar to engineers. These terms are defined in the Glossary.

Engineering classification systems

Most highway engineers classify soil materials according to the system approved by the American Association of State Highway Officials.[3] In this system soil materials are classified in seven principal groups. The groups range from A–1, in which are gravelly soils of high-bearing capacity, to A–7, which consists of clay soils that have a low strength when wet.

Some engineers prefer to use the Unified soil classification system.[4] In this system soil materials are divided into 15 classes, 8 classes consisting of coarse-grained material (GW, GP, GM, GC, SW, SP, SM, SC), 6 classes consisting of fine-grained material (ML, CL, OL, MH, CH, OH), and 1 class consisting of highly organic material (Pt). Mechanical analyses, liquid limit, and plasticity index are used to determine GM, GC, SM, SC, and fine-grained soils. The soils of the county have been classified only in the SP, SM, SC, CL, and CH classes.

Soil properties significant to engineering

Brief descriptions of all the soils in Hockley County and estimates of properties that are significant to engineering are given in table 3. In addition, the soils are evaluated for engineering purposes in table 4. The data in these tables are based on field tests of similar soils by the Bureau of Public Roads and the Texas State Highway Department, and on experience of highway engineers and local representatives of the Soil Conservation Service.

In table 3, the Unified and AASHO classifications of the soils were based on data from field tests or from the soil survey reports of Dawson, Lamb, Lynn, Terry, and Cochran Counties.

Permeability, as shown in table 3, was estimated for the soil material as it occurs without compaction.

The available water capacity, in inches per inch of depth, is an estimate of the capillary water in the soil when it is wet to field capacity. When the soil is at the wilting point of common crops, the amount of water listed in inches will wet the soil material to a depth of 1 inch without deeper percolation.

The shrink-swell potential indicates the volume change that can be expected with change in moisture content. In general, soils classified as CH and A–7 have a high shrink-swell potential. Sands and gravels having small amounts of slightly plastic fines, as well as most other nonplastic to slightly plastic soil materials, have a low shrink-swell potential.

In Hockley County dispersion is not a significant problem in the use of soils for engineering construction. There are no highly dispersed clays in Hockley County.

In table 4, specific soil features that may affect engineering work are pointed out. These features are estimated from the actual test data that are available and from field experience in the performance of the soils.

The rating of a soil for road subgrade is based on the estimated classification of the soil materials. On flat terrain, the rating applies to the soil materials in the A and B horizons, and on steeper terrain (6 percent slopes or steeper) the rating applies primarily to the soil materials in the C horizon. In soils with a plastic clay layer, such as that in Randall clay, internal drainage is impeded and the soils have low stability when wet; hence these soils are rated as *poor*. The coarser textured and better graded soils are rated as *fair*.

The suitability of a soil for road fill depends largely on its natural water content and the texture of the soil. The plastic soils, such as Randall clay, that have a high natural water content are difficult to handle, compact, and dry to the desired water content. They, therefore, are rated as *poor*. The very sandy soils are difficult to place and compact, because they do not contain enough binding materials. They are rated as *poor* to *fair*.

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[2] By Y. E. McAdams, area engineer, Soil Conservation Service, Lubbock, Texas.

[3] American Association of State Highway Officials, standard specifications for highway materials and methods of sampling and testing. Ed. 8, 2 v., illus. 1961.

[4] Waterways Experiment Station, Corps of Engineers. The unified soil classification system. Tech. memo. 3-537, vol. 1, Vicksburg, Miss. 1953.

TABLE 3.--BRIEF DESCRIPTIONS OF THE SOILS AND THEIR

Map symbol	Soil	Description of soil	Depth from surface	Classification: USDA texture	Classification: Unified
			Inches		
Afa AfB AfC	Amarillo fine sandy loam 0 to 1 percent slopes. Amarillo fine sandy loam, 1 to 3 percent slopes. Amarillo fine sandy loam, 3 to 5 percent slopes.	Fine sandy loam, 6 to 10 inches thick, over 30 to 50 inches of moderately permeable, well-drained sandy clay loam; developed on unconsolidated, moderately sandy, alluvial and eolian sediments.	0-10 10-26 26-54 54-74	Fine sandy loam--- Sandy clay loam--- Sandy clay loam--- Sandy clay loam---	SM or SC--------- SC or CL--------- SC or CL--------- SC or CL---------
AlA AlB	Amarillo loam, 0 to 1 percent slopes. Amarillo loam, 1 to 3 percent slopes.	Same as Amarillo fine sandy loam, except that the surface layer is loam, and the subsoil is 20 to 40 inches thick.	0-11 11-25 25-40 40-60	Loam------------- Sandy clay loam--- Sandy clay loam--- Sandy clay loam---	SC or CL--------- CL-------------- CL-------------- CL--------------
AmB	Amarillo loamy fine sand, 0 to 3 percent slopes.	Same as Amarillo fine sandy loam, except that the surface layer is 8 to 14 inches of loamy fine sand.	0-12 12-25 25-56 56-65	Loamy fine sand--- Sandy clay loam--- Sandy clay loam--- Sandy clay loam---	SM-------------- SC or CL--------- SC or CL--------- SC or CL---------
An	Arch fine sandy loam.	Fine sandy loam, 4 to 8 inches thick, over 6 to 12 inches of moderately rapidly permeable clay loam; developed on thick beds of soft, chalky, lime-enriched sediments; very strongly calcareous.	0-6 6-16 16-30	Fine sandy loam--- Clay loam--------- Clay loam---------	SM or SC--------- CL-------------- CL--------------
Ar	Arch clay loam.	Same as Arch fine sandy loam, except that the surface layer is clay loam.	0-8 8-19 19-30	Clay loam--------- Clay loam--------- Clay loam---------	CL-------------- CL-------------- CL--------------
AvA AvB	Arvana fine sandy loam, 0 to 1 percent slopes. Arvana fine sandy loam, 1 to 3 percent slopes.	Fine sandy loam, 6 to 10 inches thick, over 10 to 30 inches of moderately permeable, well-drained sandy clay loam; over hard, rocklike caliche.	0-8 8-30 ----	Fine sandy loam--- Sandy clay loam--- Indurated caliche-	SM or SC--------- SC or CL--------- -----------------
AxA AxB	Arvana fine sandy loam, shallow, 0 to 1 percent slopes. Arvana fine sandy loam, shallow, 1 to 3 percent slopes.	Same as the deeper phase of Arvana, except that the second layer is about 10 inches thick.	0-6 6-19 19+	Fine sandy loam--- Sandy clay loam--- Indurated caliche-	SM or SC--------- SC or CL--------- -----------------

See footnotes at end of table.

ESTIMATED PHYSICAL PROPERTIES SIGNIFICANT TO ENGINEERING

Classification--continued	Percentage passing sieve--			Permeability 1/	Available water capacity	Reaction	Shrink-swell potential
AASHO	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.74 mm.)				
				Inches per hour	Inches per inch of soil depth	pH	
A-4---------------	100	100	40-50	--------	0.125	6.7-7.8	Low.
A-6---------------	100	100	45-60	0.75-2.0	.150	7.0-7.8	Moderate.
A-6---------------	100	100	45-60	--------	.135	7.5-8.0	Moderate.
A-6---------------	100	100	45-60	--- -	.125	8.0-8.5	Moderate.
A-4 or A-6--------	100	100	45-60	--------	.150	6.8-7.8	Low.
A-6---------------	100	100	65-75	0.5-1.5	.150	6.8-7.5	Moderate.
A-6---------------	100	100	55-65	--------	.135	7.5-8.0	Moderate.
A-6---------------	100	100	55-65	--------	.125	8.0-8.5	Moderate.
A-2---------------	100	100	15-25	--------	.085	6.8-7.5	Low.
A-4 or A-6--------	100	100	40-55	1.0-2.0	.125	7.0-7.8	Moderate.
A-4 or A-6--------	100	100	40-55	--------	.125	7.8-8.0	Moderate.
A-4 or A-6--------	100	100	40-55	--------	.100	8.0-8.5	Moderate.
A-4---------------	100	100	40-50	--------	.125	8.0-8.5	Low.
A-6---------------	100	100	60-70	0.1-2.0	.150	8.0-8.5	Low.
A-6---------------	100	100	60-70	--------	.125	8.0-8.5	Low.
A-6--------------	100	100	50-60	--------	.150	8.0-8.5	Low.
A-6--------------	100	100	65-75	0.75-2.0	.150	8.0-8.5	Low.
A-6--------------	100	100	65-75	--------	.125	8.0-8.5	Low.
A-4--------------	100	100	40-50	--------	.125	6.8-7.5	Low.
A-6--------------	100	100	45-60	0.75-2.0	.140	7.0-7.5	Moderate.
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A-4--------------	100	100	40-50	--------	.125	6.8-7.5	Low.
A-6--------------	100	100	45-60	0.75-2.0	.140	7.0-7.5	Moderate.
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TABLE 3.--BRIEF DESCRIPTIONS OF THE SOILS AND THEIR

Map symbol	Soil	Description of soil	Depth from surface	Classification	
				USDA texture	Unified
			Inches		
(2/)	Berthoud loam, 3 to 5 percent slopes.	Loam, 6 to 12 inches thick, over 10 to 30 inches of moderately permeable, well-drained sandy clay loam; developed on unconsolidated, moderately sandy local alluvium.	0-9 9-20 20-50	Loam Sandy clay loam--- Sandy clay loam---	SC or CL--------- SC or CL--------- SC or CL---------
BnB	Bippus clay loam, 1 to 3 percent slopes. 3/	Clay loam, 14 to 28 inches thick over 15 to 35 inches of moderately permeable, well-drained clay loam; developed on unconsolidated, alluvial, clay loam sediments.	0-22 22-46 46-55	Clay loam--------- Clay loam--------- Clay loam---------	CL--------------- CL--------------- CL---------------
Br	Brownfield fine sand, thick surface.	Fine sand, 12 to 28 inches thick, over 10 to 20 inches of moderately permeable, well-drained sandy clay loam; over unconsolidated, moderately sandy, eolian deposits.	0-6 6-22 22-37 37-60	Fine sand--------- Fine sand--------- Sandy clay loam--- Sandy clay loam---	SP or SM--------- SP or SM--------- SC--------------- SC or CL---------
Ch	Church clay loam.	Clay loam, 3 to 8 inches thick, over 8 to 20 inches of slowly permeable, moderately well drained clay; developed on thick beds of limy, clay sediments, very strongly calcareous.	0-6 6-18 18-30	Clay loam--------- Clay loam--------- Clay--------------	CL--------------- CL--------------- CL or CH---------
DrB DrC DrD	Drake soils, 1 to 3 percent slopes. Drake soils, 3 to 5 percent slopes. Drake soils, 5 to 20 percent slopes.	Loam, 6 to 10 inches thick, over 0 to 10 inches of moderately rapidly permeable, well-drained clay loam, developed on thick beds of limy, clay loam, eolian deposits, very strongly calcareous.	0-8 8-15 15-60	Loam-------------- Clay loam--------- Clay loam---------	SC or CL--------- CL--------------- CL---------------
Km	Kimbrough soils.	Loam, 2 to 10 inches thick, over thick beds of rocklike caliche.	0-7 7+	Loam-------------- Indurated caliche-	SM, SC, or CL---- -----------------

See footnotes at end of table.

ESTIMATED PHYSICAL PROPERTIES SIGNIFICANT TO ENGINEERING--Continued

Classification--continued	Percentage passing sieve--						
AASHO	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.74 mm.)	Permeability 1/	Available water capacity	Reaction	Shrink-swell potential
				Inches per hour	Inches per inch of soil depth	pH	
A-4 or A-6-------	100	100	40-55	--------	.135	7.8-8.3	Low.
A-4 or A-6-------	100	100	45-60	1.5-3.0	.140	7.8-8.3	Moderate.
A-4 or A-6-------	100	100	45-60	--------	.140	7.8-8.3	Moderate.
A-6--------------	100	100	55-65	--------	.150	7.2-7.8	Low.
A-6--------------	100	100	55-65	1.0-2.0	.150	7.2-7.8	Moderate.
A-6--------------	100	100	55-65	--------	.135	7.5-7.9	Moderate.
A-2--------------	100	100	5-15	--------	.065	6.5-7.2	Low.
A-2--------------	100	100	5-15	--------	.065	6.6-7.0	Low.
A-4 or A-6-------	100	100	35-45	1.5-3.0	.125	6.8-7.2	Moderate.
A-4 or A-6-------	100	100	40-55	--------	.100	7.8-8.0	Moderate.
A-7--------------	100	100	65-75	--------	.165	8.0-8.3	Moderate.
A-7--------------	100	100	70-80	0.5-0.8	.185	8.0-8.3	High.
A-7--------------	100	100	80-90	--------	.150	8.0-8.3	High.
A-4 or A-6-------	100	100	45-60	--------	.125	8.0-8.5	Low.
A-6--------------	100	100	55-65	1.5-3.5	.135	8.0-8.5	Moderate.
A-6--------------	100	100	55-65	--------	.085	8.0-8.5	Moderate.
A-4 or A-6-----	100	100	35-55	0.75-1.5	.010	7.0-7.5	Low.
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TABLE 3.--BRIEF DESCRIPTIONS OF THE SOILS AND THEIR

Map symbol	Soil	Description of soil	Depth from surface	Classification	
				USDA texture	Unified
			Inches		
(4/)	Lea loam, shallow.	Loam, 4 to 8 inches thick, over 4 to 20 inches of slowly permeable, well-drained clay loam; over thick beds of rocklike caliche.	0-6 6-12 12-17 17+	Loam------------- Clay loam--------- Clay loam--------- Indurated caliche-	SC or CL--------- CL--------------- CL--------------- -----------------
MfA MfB	Mansker fine sandy loam, 0 to 1 percent slopes. Mansker fine sandy loam, 1 to 3 percent slopes.	Fine sandy loam, 5 to 11 inches thick, over 4 to 15 inches of moderately rapidly permeable, well drained sandy clay loam; developed on unconsolidated, moderately sandy, alluvial and eolian sediments.	0-8 8-17 17-30	Fine sandy loam--- Sandy clay loam--- Sandy clay loam---	SM or SC--------- CL--------------- CL---------------
MkA MkB	Mansker loam, 0 to 1 percent slopes. 5/ Mansker loam, 1 to 3 percent slopes.	Same as Mansker fine sandy loam, except that the surface layer is loam and the subsoil is clay loam.	0-7 7-15 15-30	Loam------------- Clay loam--------- Clay loam---------	CL--------------- CL--------------- CL---------------
OtA	Olton loam, 0 to 1 percent slopes.	Loam, 4 to 10 inches thick, over 14 to 35 inches of slowly permeable, well-drained clay loam; developed on unconsolidated, alluvial and eolian clay loam.	0-7 7-12 12-24 24-38 38-56	Loam------------- Clay loam--------- Clay loam--------- Clay loam--------- Clay loam---------	CL--------------- CL--------------- CL or CH--------- CL--------------- CL---------------
PfA PfB	Portales fine sandy loam, 0 to 1 percent slopes. Portales fine sandy loam, 1 to 3 percent slopes.	Fine sandy loam, 5 to 10 inches thick, over 20 to 40 inches of moderately rapidly permeable, well-drained clay loam; developed on unconsolidated, alluvial and eolian clay loam.	0-8 8-16 16-34 34-60	Fine sandy loam--- Sandy clay loam--- Clay loam--------- Clay loam---------	SM or SC--------- SC or CL--------- CL--------------- CL---------------
PmA PmB	Portales loam, 0 to 1 percent slopes. Portales loam, 1 to 3 percent slopes.	Same as Portales fine sandy loam, except that the surface layer is loam.	0-7 7-28 28-40	Loam------------- Clay loam--------- Clay loam---------	CL--------------- CL--------------- CL---------------
Ps	Potter soils.	Loam, 2 to 10 inches thick, developed on thick beds of unconsolidated, alluvial and eolian, sandy clay loam sediments.	0-7 7-40	Loam------------- Sandy clay loam---	ML or CL--------- SC or CL---------

See footnotes at end of table.

ESTIMATED PHYSICAL PROPERTIES SIGNIFICANT TO ENGINEERING--Continued

Classification--continued	Percentage passing sieve--			Permeability 1/	Available water capacity	Reaction	Shrink-swell potential
AASHO	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.74 mm.)				
				Inches per hour	Inches per inch of soil depth	pH	
A-6--------------	100	100	45-60	--------	.125	7.8-8.0	Moderate.
A-6--------------	100	100	55-65	--------	.140	8.0-8.3	Moderate.
A-6--------------	100	100	55-65	1.0-2.0	.150	8.0-8.3	Moderate.
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A-4--------------	100	100	40-50	--------	.125	8.0-8.3	Low.
A-6--------------	100	100	50-60	1.5-3.0	.150	8.0-8.3	Low.
A-6--------------	100	95-100	50-60	--------	.065	8.0-8.5	Low.
A-6--------------	100	100	50-60	--------	.165	8.0-8.3	Moderate.
A-6--------------	100	100	55-65	1.0-2.0	.165	8.0-8.3	Moderate.
A-6--------------	100	95-100	55-65	--------	.085	8.0-8.5	Moderate.
A-6--------------	100	100	55-65	--------	.175	7.0-7.5	Moderate.
A-6--------------	100	100	65-75	--------	.185	7.2-7.5	Moderate.
A-6 or A-7-------	100	100	70-80	0.5-1.0	.185	7.2-7.8	High.
A-6--------------	100	100	65-75	--------	.185	7.2-7.8	Moderate.
A-6--------------	100	95-100	65-75	--------	.135	8.0-8.5	Moderate.
A-4--------------	100	100	40-50	--------	.125	7.8-8.2	Low.
A-6--------------	100	100	45-55	--------	.140	8.0-8.3	Moderate.
A-6--------------	100	100	55-65	1.5-3.0	.140	8.0-8.3	Moderate.
A-6--------------	100	95-100	55-65	--------	.100	8.0-8.5	Low.
A-6--------------	100	95-100	50-60	--------	.150	7.8-8.2	Moderate.
A-6--------------	100	95-100	55-65	1.0-2.0	.150	8.0-8.3	Moderate.
A-6--------------	100	95-100	55-65	--------	.100	8.0-8.5	Low.
A-4 or A-6-------	90-100	85-95	50-60	1.0-2.0	.125	8.0-8.5	Low.
A-6--------------	85-95	85-95	45-55	--------	.085	8.0-8.5	Low.

TABLE 3.--BRIEF DESCRIPTIONS OF THE SOILS AND THEIR

Map symbol	Soil	Description of soil	Depth from surface	Classification	
				USDA texture	Unified
			Inches		
Ra	Randall clay.	Clay, 15 to 22 inches thick, over 18 to 20 inches of poorly drained, very slowly permeable clay; developed on unconsolidated, firm clay sediments.	0-8 8-20 20-38 38-45	Clay-------------- Clay-------------- Clay-------------- Clay--------------	CL--------------- CL or CH--------- CL or CH--------- CL or CH---------
Rf	Randall fine sandy loam.	Same as Randall clay, except that the texture of the upper 8 to 20 inches is fine sandy loam.	0-10 10-40 40-60	Fine sandy loam--- Clay-------------- Clay--------------	SM or SC--------- CL--------------- CL or CH---------
(6/)	Spur loam.	Loam, 4 to 10 inches thick, over 27 to 55 inches of moderately permeable, well-drained clay loam; developed on unconsolidated, alluvial, clay loam sediments.	0-6 6-24 24-50 50-60	Loam-------------- Clay loam--------- Clay loam--------- Clay loam---------	SM, SC, or CL---- CL--------------- CL--------------- CL---------------
(4/)	Stegall loam, shallow.	Loam, 4 to 8 inches thick, over 5 to 19 inches of slowly permeable, well-drained clay loam; over hard, rocklike caliche.	0-7 7-14 14-18 18+	Loam-------------- Clay loam--------- Clay loam--------- Indurated caliche-	CL--------------- CL--------------- CL--------------- -----------------
Tv	Tivoli fine sand.	Loose fine sand, 4 to 20 inches thick, developed on rapidly permeable, well-drained, eolian fine sand, 2 to 15 feet thick, over moderately permeable, moderately sandy buried soil.	0-12 12-58 58-70 70-75	Fine sand--------- Fine sand--------- Fine sandy loam--- Sandy clay loam---	SP or SM--------- SP or SM--------- SM--------------- SC or CL---------

See footnotes at end of table.

ESTIMATED PHYSICAL PROPERTIES SIGNIFICANT TO ENGINEERING--Continued

Classification--continued	Percentage passing sieve--			Permeability 1/	Available water capacity	Reaction	Shrink-swell potential
AASHO	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.74 mm.)				
				Inches per hour	Inches per inch of soil depth	pH	
A-7--------------	100	100	75-85	--------	.200	6.8-8.0	High.
A-7--------------	100	100	75-90	--------	.200	6.8-8.0	High.
A-7--------------	100	100	75-90	0.02-0.2	.200	6.8-8.0	High.
A-7--------------	100	95-100	75-90	--------	.200	6.8-8.0	High.
A-4--------------	100	100	40-50	--------	.125	6.8-7.5	Low.
A-6--------------	100	100	70-80	0.1-0.5	.165	6.8-7.8	Moderate.
A-6 or A-7-------	100	95-100	75-90	--------	.165	6.8-8.0	High.
A-4 or A-6-------	100	100	35-55	--------	.165	7.5-8.2	Moderate.
A-6--------------	100	100	60-70	1.0-2.0	.165	7.8-8.2	Moderate.
A-6--------------	100	100	60-70	--------	.165	8.0-8.3	Moderate.
A-6--------------	100	100	60-70	--------	.165	8.0-8.3	Moderate.
A-6--------------	100	100	50-60	--------	.150	7.5-7.8	Moderate.
A-6--------------	100	100	60-70	--------	.165	7.5-7.8	High.
A-6--------------	100	100	60-70	0.5-1.0	.165	7.5-7.8	High.
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A-3--------------	100	100	5-10	--------	.065	6.5-7.5	Low.
A-3--------------	100	100	5-10	2.0-4.0	.065	6.5-7.5	Low.
A-4--------------	100	100	35-45	--------	.100	6.5-7.5	Low.
A-4 or A-6-------	100	100	40-55	--------	.125	6.5-7.5	Moderate.

TABLE 3.--BRIEF DESCRIPTIONS OF THE SOILS AND THEIR

Map symbol	Soil	Description of soil	Depth from surface	Classification	
				USDA texture	Unified
			Inches		
ZfA	Zita fine sandy loam, 0 to 1 percent slopes.	Fine sandy loam, 4 to 10 inches thick, over 10 to 30 inches of moderately permeable, well-drained sandy clay loam; developed on unconsolidated, eolian and alluvial, clay loam sediments.	0-6	Fine sandy loam---	SM or SC---------
			6-18	Sandy clay loam---	SC or CL---------
			18-23	Clay loam---------	CL---------------
			23-40	Clay loam---------	CL---------------
ZmA	Zita loam, 0 to 1 percent slopes.	Same as Zita fine sandy loam, except that the surface layer is loam and subsoil is clay loam.	0-7	Loam--------------	CL---------------
			7-18	Clay loam---------	CL---------------
			18-24	Clay loam---------	CL---------------
			24-35	Clay loam---------	CL---------------

1/ Permeability given is that of the least permeable horizon.

2/ Mapped only in the complex, Berthoud-Mansker loams, 3 to 5 percent slopes.

3/ Also mapped in the undifferentiated mapping unit, Spur and Bippus soils.

Soil material and soil drainage affect the vertical alinement, or placement, of highways. These factors are rated in table 4 (p. 44). Cuts made in sand dunes, such as Tivoli fine sand, expose highly erodible material to the action of wind and water. Cuts made in soils that have highly plastic clay layers, such as in Randall clay, require slopes with less gradient because these soils are more susceptible to sloughing and sliding. Excavation of a rocklike caliche layer—as in the Arvana soils, Kimbrough soils, and Stegall loam—might require the use of special equipment.

The Arvana, Kimbrough, Stegall, and Potter soils are possible sources of hard caliche, which can be used in road construction and surfacing. Bedrock is not likely to be encountered. The soils in Hockley County do not provide a source of sand or gravel.

The soils in this county are suited to the surface and sprinkler methods of irrigation. Sprinkler irrigation can be used on all the soils, and it is the best system for irrigating coarse-textured, shallow, or rolling soils. Surface irrigation may be preferable to the sprinkler method on fine-textured and medium-textured soils that have a depth of 20 inches or more and have nearly level, uniform slopes.

Field terraces and diversion terraces constructed of coarse-textured soils are difficult to maintain. Wind erosion is a serious hazard in maintaining terrace ridges and channels at desired specifications.

The soils of Hockley County do not have good stability for construction of waterways. Waterways can be constructed, however, if they are carefully stabilized. Accumulations of windblown material in waterways constructed on highly erodible soils create a difficult maintenance problem.

Dikes and levees are not needed in this county. If they were needed, they could be constructed on most of the soils that can be terraced.

Farm ponds are not generally constructed in Hockley County because (1) good sites are not available; (2) the sandy watersheds do not supply dependable surface flow to ponds; (3) excessive seepage losses occur in the sandy soils; and (4) underground water is available for livestock.

Winter grading and frost action are not problems, because the soils generally have a low moisture content during the winter, and subfreezing temperatures last for only short periods.

Genesis, Classification, and Morphology of Soils

In this section the factors that have affected the formation of the soils are discussed. The soils are classified by higher categories and their outstanding morphological characteristics are described. Technical terms used in this section are defined in the Glossary.

Factors of Soil Formation

Soil is produced by soil-forming processes acting on materials that have been deposited or accumulated by geologic agencies. The characteristics of soil at any given

ESTIMATED PHYSICAL PROPERTIES SIGNIFICANT TO ENGINEERING--Continued

Classification--continued	Percentage passing sieve--			Permeability 1/	Available water capacity	Reaction	Shrink-swell potential
AASHO	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.74 mm.)				
				Inches per hour	Inches per inch of soil depth	pH	
A-4--------------	100	100	40-50	--------	.135	7.5-7.8	Low.
A-4 or A-6-------	100	100	45-60	1.0-2.5	.150	7.5-7.8	Moderate.
A-6--------------	100	95-100	55-65	--------	.125	8.0-8.3	Moderate.
A-6--------------	100	95-100	55-65	--------	.085	8.0-8.5	Moderate.
A-6--------------	100	100	50-60	--------	.165	7.5-7.8	Moderate.
A-6--------------	100	100	55-65	--------	.165	7.5-7.8	Moderate.
A-6--------------	100	100	55-65	1.0-2.0	.150	8.0-8.3	Moderate.
A-6--------------	100	95-100	55-65	--------	.085	8.0-8.5	Moderate.

4/ Mapped only in the complex, Stegall-Lea loams, shallow.

5/ Mansker loam is mapped also in the complex, Berthoud-Mansker loams, 3 to 5 percent slopes.

6/ Mapped only in the undifferentiated mapping unit, Spur and Bippus soils.

point are determined by (1) the physical and mineralogical composition of the parent material; (2) the climate under which the soil material has accumulated and remained; (3) the plant and animal life on and in the soil; (4) the relief, or lay of the land; and (5) the length of time the forces of soil development have acted on the soil material.

Climate and vegetation are active soil-forming factors. They act on the parent material that has accumulated through the weathering of rocks, and slowly change it into a natural body with genetically related horizons. The effects of climate and vegetation are conditioned by relief. The parent material also affects the kind of profile that forms and, in extreme cases, determines it almost entirely. Finally, time is necessary to change the parent material into a soil profile. The time may be long or short, but some time is always required for horizon differentiation. Usually a long time is required to develop distinct horizons.

The factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made about the effect of any one factor alone. Furthermore, many of the processes of soil development are unknown.

Parent material

The materials from which soils form are composed of varying amounts of sand, silt, and clay. The materials also have different kinds and amounts of chemicals and are exposed to various kinds of climate. All the other soil-forming factors affect parent material, but parent material often determines the character of the soil. It is perhaps the most important of the soil-forming factors.

The parent materials of the soils of Hockley County are water deposited and windblown. Since their original deposition, nearly all parent materials have been reworked and sorted by wind. These parent materials were largely calcareous, unconsolidated, sandy and silty earths. The predominant Amarillo soils of this county developed from such materials. In some areas, such as those where the limy Arch and Church soils formed, the calcium content has been increased by precipitation of soluble calcium from an intermittent high water table. In some areas the parent materials are sandier, more siliceous, and lower in base than the parent material of finer textured soils. They are usually lower in carbonates and higher in quartz than the more clayey materials.

Climate

Precipitation, temperature, humidity, and wind have been important in the development of the soils of Hockley County. The wet and dry climatic cycles of past geologic ages have influenced the deposition of parent materials. Materials laid down by water in wet periods were reworked and mixed by wind during dry periods.

Later, as the soils were developing, calcium carbonate accumulated because the rainfall leached it downward, but there was not enough rainfall to remove it from the soil. Many soils—probably the most youthful—still have free lime throughout the profile.

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TABLE 4.--ENGINEERING

[No entry in column indicates that

Map symbol	Soil	Suitability of soil for-- Road subgrade	Road fill	Topsoil	Vertical alinement of highways: Material	Drainage
AfA	Amarillo fine sandy loam, 0 to 1 percent slopes.	Poor to fair--	Fair----------	Fair----------	Poor to fair--	Good--
AfB	Amarillo fine sandy loam, 1 to 3 percent slopes.					
AfC	Amarillo fine sandy loam, 3 to 5 percent slopes.					
AlA	Amarillo loam, 0 to 1 percent slopes.	Poor to fair--	Fair--------	Fair to good--	Poor to fair--	Fair--
AlB	Amarillo loam, 1 to 3 percent slopes.					
AmB	Amarillo loamy fine sand, 0 to 3 percent slopes.	Fair----------	Fair----------	Poor to fair--	Poor to fair--	Good--
An	Arch fine sandy loam.	Poor to fair--	Fair----------	Poor----------	Poor to fair--	Good--
Ar	Arch clay loam.	Poor to fair--	Poor to fair--	Poor----------	Poor----------	Good--
AvA	Arvana fine sandy loam, 0 to 1 percent slopes.	Poor to fair--	Fair----------	Fair----------	Poor to fair--	Good--
AvB	Arvana fine sandy loam, 1 to 3 percent slopes.					
AxA	Arvana fine sandy loam, shallow, 0 to 1 percent slopes.	Poor to fair--	Fair----------	Fair----------	Poor to fair--	Good--
AxB	Arvana fine sandy loam, shallow, 1 to 3 percent slopes.					
(1/)	Berthoud loam, 3 to 5 percent slopes.	Poor to fair--	Fair----------	Fair to good--	Poor to fair--	Good--
BnB	Bippus clay loam, 2/ 1 to 3 percent slopes.	Poor to fair--	Poor to fair--	Fair----------	Fair----------	Fair--

See footnotes at end of table.

INTERPRETATIONS OF SOILS

there are no adverse characteristics]

Soil characteristics affecting--					Remarks
Irrigation		Land leveling	Construction of field terraces and diversion terraces	Construction of waterways	
Sprinkler system	Surface system				
Moderate water-holding capacity.	High intake rate; high seepage loss in earthen ditches.	Not practical on slopes of more than 3 percent.	----------------	Fair stability--	Strongly calcareous substrata.
High water-holding capacity.	Moderate intake rate; moderate seepage loss in earthen ditches.	-----------------	----------------	Fair stability--	Strongly calcareous substrata.
Moderate water-holding capacity.	Very high intake rate; excessive seepage loss in earthen ditches.	Sandy surface creates maintenance problems.	Sandy surface creates maintenance problems; gently undulating topography.	Poor stability--	Strongly calcareous substrata.
Low water-holding capacity.	Very high intake rate; excessive seepage loss in earthen ditches.	Lime content limits cuts and increases maintenance problems.	Lime content increases maintenance problems.	Poor stability--	Strongly calcareous throughout.
Low water-holding capacity.	High intake rate; high seepage loss in earthen ditches.	Lime content limits cuts and increases maintenance problems.	Lime content increases maintenance problems.	Poor stability--	Strongly calcareous throughout.
Moderate water-holding capacity.	High intake rate; high seepage loss in earthen ditches.	Hard caliche limits cuts.	Occasional small areas of rock outcrops.	Fair stability--	Rocklike caliche at a depth of 20 to 36 inches.
Low water-holding capacity.	High intake rate; limited water-holding capacity.	Not practical because of shallow depth.	Not practical because of shallow depth.	Fair stability--	Rocklike caliche at a depth of 10 to 20 inches.
Moderate water-holding capacity.	Steep slopes; high intake rate.	Not practical because of slopes.	Short slopes greater than 3 percent.	Poor to fair stability.	Occurs on short slopes along the small draws.
High water-holding capacity.	Moderate intake rate.	-----------------	Short slopes---	Fair stability--	Occurs on short slopes.

TABLE 4.--ENGINEERING

Map symbol	Soil	Suitability of soil for-- Road subgrade	Road fill	Topsoil	Vertical alinement of highways: Material	Vertical alinement of highways: Drainage
Br	Brownfield fine sand, thick surface.	Poor to fair--	Fair to good--	Poor----------	Poor to fair--	Good--
Ch	Church clay loam.	Poor----------	Poor----------	Poor----------	Poor to fair--	Fair--
DrB	Drake soils, 1 to 3 percent slopes.	Poor to fair--	Poor to fair--	Poor----------	Poor to fair--	Good--
DrC	Drake soils, 3 to 5 percent slopes.					
DrD	Drake soils, 5 to 20 percent slopes.					
Km	Kimbrough soils.	Poor to fair--	Poor to fair--	Fair----------	Poor to fair--	Good--
(3/)	Lea loam, shallow.	Poor to fair--	Poor to fair--	Fair----------	Poor to fair--	Good--
MfA	Mansker fine sandy loam, 0 to 1 percent slopes.	Poor to fair--	Poor to fair--	Poor to fair--	Poor to fair--	Good--
MfB	Mansker fine sandy loam, 1 to 3 percent slopes.					
MkA	Mansker loam, 4/ 0 to 1 percent slopes.	Poor to fair--	Poor to fair--	Fair----------	Poor to fair--	Good--
MkB	Mansker loam, 1 to 3 percent slopes.					
OtA	Olton loam, 0 to 1 percent slopes.	Poor----------	Poor to fair--	Fair to good--	Poor to fair--	Fair--
PfA	Portales fine sandy loam, 0 to 1 percent slopes.	Poor to fair--	Fair----------	Fair----------	Poor to fair--	Good--
PfB	Portales fine sandy loam, 1 to 3 percent slopes.					

See footnotes at end of table.

INTERPRETATIONS OF SOILS--Continued

Soil characteristics affecting--						Remarks
Irrigation		Land leveling	Construction of field terraces and diversion terraces	Construction of waterways		
Sprinkler system	Surface system					
Moderate water-holding capacity.	Very high intake rate; undulating topography.	Not practical because of wind erosion hazard.	Not practical because of thick sand surface and undulating.	Unsuitable------		Sandy surface; undulating topography.
High water-holding capacity.	Low intake rate--	High wind erosion hazard.	High wind erosion hazard.	Fair stability--		Strongly calcareous throughout.
Low water-holding capacity.	High intake rate; steep slopes.	High wind erosion hazard; steep slopes.	Lime content increases maintenance problem; not practical on steeper slopes.	Unsuitable on steeper slopes.		Strongly calcareous throughout.
Not practical; very low water-holding capacity.	Unsuitable; very shallow.	Not suitable; very shallow depth.	Not suitable; very shallow depth.	Unsuitable; very shallow.		Rocklike caliche at a depth less than 10 inches.
Low water-holding capacity.	High intake rate--	Shallow depth limits cuts.	Not practical; shallow depth.	Fair stability--		Rocklike caliche at 10- to 20-inch depth.
Low water-holding capacity.	High intake rate--	Shallow depth limits cuts.	Not practical; shallow depth.	Poor stability--		Strongly calcareous throughout.
Low water-holding capacity.	High intake rate--	Shallow depth limits cuts.	Not practical; shallow depth.	Fair stability--		Strongly calcareous throughout.
High water-holding capacity.	Low intake rate--	-----------------	----------------	Fair stability--		Occurs in broad, nearly level areas.
Moderate water-holding capacity.	High intake rate--	-----------------	----------------	Fair stability--		Calcareous throughout.

TABLE 4.--ENGINEERING

Map symbol	Soil	Suitability of soil for--				
		Road subgrade	Road fill	Topsoil	Vertical alinement of highways	
					Material	Drainage
PmA	Portales loam, 0 to 1 percent slopes.	Poor to fair--	Fair----------	Fair----------	Poor to fair--	Good--
PmB	Portales loam, 1 to 3 percent slopes.					
Ps	Potter soils.	Poor to fair--	Fair----------	Poor----------	Fair----------	Good--
Ra	Randall clay.	Poor----------	Poor----------	Poor----------	Poor----------	Poor--
Rf	Randall fine sandy loam.	Poor----------	Poor to fair--	Fair----------	Poor to fair--	Poor--
(5/)	Spur loam.	Poor to fair--	Poor to fair--	Good----------	Poor to fair--	Fair--
(3/)	Stegall loam, shallow.	Poor----------	Poor to fair--	Fair----------	Poor to fair--	Fair--
Tv	Tivoli fine sand.	Poor to fair--	Fair----------	Poor----------	Poor----------	Good--
ZfA	Zita fine sandy loam, 0 to 1 percent slopes.	Poor to fair--	Fair----------	Fair----------	Poor to fair--	Good--
ZmA	Zita loam, 0 to 1 percent slopes.	Poor to fair--	Fair----------	Fair to good--	Poor to fair--	Good--

1/ Mapped only in the complex, Berthoud-Mansker loams, 3 to 5 percent slopes.

2/ Also mapped in the undifferentiated unit, Spur and Bippus soils.

3/ Mapped only in the complex, Stegall-Lea loams, shallow.

INTERPRETATIONS OF SOILS--Continued

Soil characteristics affecting--					Remarks
Irrigation		Land leveling	Construction of field terraces and diversion terraces	Construction of waterways	
Sprinkler system	Surface system				
Moderate water-holding capacity.	Moderate intake rate.	------------------	----------------	Fair stability--	Calcareous throughout.
Unsuitable; very shallow.	Unsuitable; very shallow.	Unsuitable; very shallow.	Unsuitable; very shallow.	Unsuitable; steep slope.	Strongly calcareous throughout.
High water-holding capacity.	Very low intake rate.	High shrink-swell potential increases maintenance problems.	Not applicable, because of low position.	Not applicable--	Frequently flooded; playa beds.
High water-holding capacity.	Very low intake rate.	------------------	Not applicable, because of low position.	Not applicable--	Frequently flooded; playa beds.
High water-holding capacity.	Moderate intake rate; moderate seepage loss in earthen ditches.	------------------	No problem, but not needed because of position.	Not applicable	Occurs in hollows or small draws.
Low water-holding capacity.	Low intake rate--	Not practical because of shallow depth.	Not practical because of shallow depth.	Fair stability--	Rocklike caliche occurs at 10- to 20-inch depth.
Very low water-holding capacity.	Unsuitable-----	Unsuitable--------	Unsuitable-------	Unsuitable-----	Deep sands; duned topography.
Moderate water-holding capacity.	High intake rate, high seepage loss in earthen ditches.	------------------	----------------	Fair stability--	Strongly calcareous substratum.
High water-holding capacity.	Moderate intake rate; moderate seepage loss in earthen ditches.	-------------------	----------------	Fair stability--	Strongly calcareous. substratum.

4/ Mapped also in the complex, Berthoud-Mansker loams, 3 to 5 percent slopes.

5/ Mapped only in the undifferentiated unit, Spur and Bippus soils.

Wind is an outstanding factor in the development of soils in this area. It has affected soil development from the time it deposited sands over alluvial materials in the Illinoian stage of the Pleistocene to the present, when it shifts coarse sands on the surface.[5]

Plant and animal life

Vegetation, micro-organisms, earthworms, and other forms of life that live on and in the soil contribute to its development. The kind and amount of vegetation are important and are determined by climate and parent material or by the kind of soil. The climate of Hockley County limited native vegetation to grasses, and the parent material influenced the kind of grass on each site. Taller grasses grew on the sandier materials, and shorter grasses on the more clayey materials.

In the complex of living organisms that affected soil development, the native vegetation was most important. The mixed prairie type of vegetation contributed large amounts of organic matter to the soil. Decaying grass left organic matter on the soil surface, and decaying fine roots left organic matter in the soil. The maze of tubes and pores left by the decaying roots allowed the passage of air and water through the soil and provided food for bacteria, actinomycetes, and fungi.

Earthworms are the most noticeable animal life in the soil. Worm casts help the movement of air, water, and plant roots in the soil. In some areas of Portales and Zita soils, worm casts make up 30 to 40 percent of the subsoil.

Since the settlement of Hockley County, man has influenced the direction and rate of soil formation. He has altered the natural balance of the soils by irrigating, by changing vegetation, by tilling and compacting the soils, and by reducing the amount of organic matter and the amount of silt and clay particles in the surface layer. In Hockley County in the last 35 years, man has drastically altered the complex of living organisms that affect soil. These changes will be reflected in the future direction and rate of soil formation.

Relief

Hockley County is part of a large, nearly level plain that slopes gently to the southeast. In most areas the slope is less than 2 percent. This nearly level relief has helped the soils to retain moisture, and deep soils have formed. Near playas, saline lakes, or drainageways, however, some areas have a slope of 2 to 8 percent, and here the soils are generally thinner because less moisture enters them. As a result soil formation is slow. On the steeper slopes, soil is being eroded about as fast as it forms.

Time

Time is necessary for climate, relief, and living organisms to change parent material into a soil. The length of time required for a soil to mature, or reach a state of equilibrium with its environment, depends on the combined action of the other soil-forming factors and on the intensity of the action. Mature soils have well-defined, genetically related horizons. In Hockley County soils develop in a dry climate under sparse vegetation. This kind of climate and vegetation act slowly. Therefore, a long time is required for a soil to reach maturity.

[5] FRYE, JOHN C., and LEONARD, A. BYRON. STUDIES OF CENOZOIC GEOLOGY ALONG EASTERN MARGIN OF TEXAS HIGH PLAINS, ARMSTRONG TO HOWARD COUNTIES. Univ. of Tex., Bur. Econ. Geol. Rept. of Inv. No. 32, 62 pp., illus. 1957.

Classification of Soils

Soils are placed in narrow classes so that knowledge about them can be applied to small areas such as farms, ranches, or counties. They are placed in broad classes for the study and comparison of large areas, such as continents. In the system of soil classification followed in the United States, the soils are placed in six categories, one above the other. Beginning at the top, the six categories are order, suborder, great soil group, family, series, and type.[6]

In the highest category, the soils of the whole country are grouped into three orders, whereas thousands of soil types are recognized in the lowest category. The suborder and family categories have never been fully developed and thus have been little used. Soils have been classified by types and series within counties or comparable areas and the series have been grouped into great soil groups and orders. Subdivision of soil types into phases provides finer distinctions for soil use and management. Soil series, type, and phase are defined in the Glossary in the back of this report.

In the highest category of the classification scheme are the *zonal*, *intrazonal*, and *azonal* orders.[7] Soils in the zonal order have evident, genetically related horizons that reflect the predominant influence of climate and living organisms in their formation. Soils in the intrazonal order have evident, genetically related horizons that reflect the dominant influence of a local factor of topography or parent material over the effects of climate and living organisms. Soils in the azonal order lack distinct, genetically related horizons, generally because of youth, resistant parent material, or steep topography.

In the following tabulation, the soil series are classified by higher categories. Following the tabulation is a discussion of the orders and great soil groups in the county.

Order and great soil group	*Series*
Zonal—	
Chestnut	Bippus, Stegall, Zita (Zita soils intergrade toward Calcisols).
Reddish Brown	Brownfield.
Reddish Chestnut	Amarillo, Arvana, Olton.
Intrazonal—	
Calcisol	Arch, Church, Lea, Mansker, Portales.
Grumusol	Randall.
Azonal—	
Alluvial	Spur.
Lithosol	Kimbrough, Potter.
Regosol	Berthoud, Drake, Tivoli.

[6] BALDWIN, M. KELLOGG, C. E., and THORP, JAMES. SOIL CLASSIFICATION. U.S. Dept. of Agr. Ybk., Soils and Men, pp. 979–1001. 1938.

[7] THORP, JAMES, and SMITH, GUY D. HIGHER CATEGORIES OF SOIL CLASSIFICATION: ORDER, SUBORDER, AND GREAT SOIL GROUPS. Soil Sci. 67: 117–126. 1949.

Zonal order

In Hockley County the Chestnut, Reddish Brown, and Reddish Chestnut great soil groups are in the zonal order.

CHESTNUT SOILS

The Bippus, Stegall, and Zita series are in this great soil group. These soils are all similar in some respects. They all occur in low or slightly depressed positions and have received some extra water as runoff.

These soils developed a thick, dark-brown or dark grayish-brown A horizon. This thick A horizon is dominantly saturated with bivalent cations and has a narrow carbon-nitrogen ratio and about 1 to 2 percent organic matter.

The Stegall soils have a thick, strong B horizon well enriched with clay. The Bippus and Zita soils generally do not have a B horizon with clay enrichment, although they have a thick A horizon. The Zita soils intergrade toward the Calcisol group and have a strong ca horizon at a depth of 1½ to 4 feet. Stegall soils have a Drca layer of indurated caliche at a depth of 1 to 2 feet.

REDDISH BROWN SOILS

The Brownfield is the only series in this great soil group in Hockley County. These Reddish Brown soils have a thick, brown, fine sand A horizon over a thick, sandy clay loam B horizon. The A horizon generally has less than one-half percent of organic matter. The sandy, wind-deposited parent material overlies a buried soil in many places. The Brownfield soils have undulating relief.

REDDISH CHESTNUT SOILS

This great soil group is very extensive in Hockley County. The Amarillo, Arvana, and Olton series are in this group. These soils occur on the broad, nearly level to gently sloping areas in most parts of the county. They have a thick, brown to reddish-brown, friable A horizon that grades to a prominent B horizon of illuvial clay. The Amarillo and Olton soils have a thick ca horizon, whereas the Arvana soils have a Drca layer of indurated caliche.

The thick A horizon has high base-exchange capacity, a narrow carbon-nitrogen ratio, and about 0.6 to 1.3 percent organic matter.

Although parent material has influenced the color and texture of these soils, their genetically related horizons and other soil characteristics indicate that climate and living organisms have been the dominant influence in their formation.

Intrazonal order

In Hockley County, two great soil groups, the Calcisols and Grumusols, are in the intrazonal order.

CALCISOLS

The Arch, Church, Lea, Mansker, and Portales series are in this great soil group. These soils are characterized by a thick zone of calcium carbonate accumulation, 10 to 36 inches below the surface. They also have free lime throughout the soil profile.

The horizon sequence is A, AC, Cca, and C. The color of the A horizon ranges from grayish brown to pale brown. The A horizon is moderately thick to thick and, in the virgin areas, grades to the AC horizon. The AC is lighter in color than the A and contains more free lime.

These soils are saturated with bases, have a narrow carbon-nitrogen ratio, and have about ½ to 2 percent organic matter. The Arch and Church soils occur in slightly lower positions than surrounding soils.

Apparently, their parent material consists of late Pleistocene limy sediments that were calcified by a shallow water table before the development of the present soil. The Portales soils are deeper and less limy than the Arch or Church soils, possibly because they are somewhat more mature or have developed from less limy material than the Arch and Church soils. The morphology of Arch, Church, Lea, and Portales soils has been influenced more by parent material and time than by other factors. Mansker soils occur in places on slopes as steep as 5 percent; therefore, their development is greatly influenced by relief as well as by other factors.

GRUMUSOLS

The Randall is the only series in this great soil group in Hockley County. These soils have developed from clayey material in the playa beds. Because of their low position, they developed under wet conditions.

These are the only soils in Hockley County that have a high content of montmorillonite clay. Some areas are noncalcareous and others are calcareous, but in most areas the pH is more than 7.0.

These soils receive much runoff from surrounding soils. They may be inundated for only a few days or for several months, and there are periods when the lakebeds in which they occur are dry. When the beds are dry, the soils crack, and soil material sloughs into these cracks or is washed or blown into them. When the soils are wet again, they swell and shearing occurs. Because of this mass movement, the Randall soils are unstable.

Azonal order

In Hockley County three great soil groups—Alluvial, Lithosol, and Regosol—are in the azonal order. The azonal soils generally have a rather weak A1 horizon.

ALLUVIAL SOILS

In this county only the Spur series is in the Alluvial great soil group. These inextensive soils occur only in the small draws or drainageways.

The Spur soils are immature. They have not had enough time for development of distinct horizons. They are brown or grayish brown and ordinarily have free lime throughout the solum. These soils do not have a distinct ca horizon and are commonly stratified below 3 feet.

LITHOSOLS

The Kimbrough and Potter series are in this great soil group. These soils are less than 10 inches deep.

The Kimbrough soils are very shallow because of their parent material. They have developed on thick beds of indurated calcium carbonate. The Potter soils, however, are very shallow because of their relief. They are on steep slopes where geologic erosion removes soil as it develops.

REGOSOLS

In this great soil group are the Berthoud, Drake, and Tivoli series. These soils, like the Alluvial soils, also have weak horizonation. This could be due to parent material or to time.

The soils of the Berthoud series have developed from recent colluvium along the slopes of draws or other dissected areas of the county. They have a weak A horizon darkened by organic matter, and they may have a faint ca horizon. Free lime occurs throughout the profile.

The Drake soils developed from materials of eolian origin that are very high in lime. The parent material was deposited in dunes to the leeward of playas. These soils are immature because of parent material and time. Only a weak A horizon is evident.

The soils in the Tivoli series developed from material that is about 95 percent quartz sand. This kind of material contains very little clay or minerals that are subject to weathering. A weak A1 horizon, darkened by organic matter, is generally the only identifiable horizon. Parent material is the major factor in development of the soils of this series.

Descriptions of Soil Series and Representative Profiles

In this subsection the soil series and representative profiles are described in alphabetical order. The range in characteristics of the various layers is shown after the profile description.

Amarillo series

The Amarillo series consists of reddish-brown soils in the Reddish Chestnut great soil group. They have developed from unconsolidated, calcareous, alluvial material and from eolian, sandy clay loam material. Amarillo soils are in all parts of the county in nearly level or gently sloping areas. They are well drained internally and are moderately permeable.

Three soil types are in the Amarillo series. They are loam, fine sandy loam, and loamy fine sand. The Amarillo soils are deeper than the Arvana soils. They have a more sandy subsoil than the Olton. They are redder than the Portales and the shallow Mansker soils and have a textural B horizon, which those soils do not have. They are redder than the Zita soils and do not have the chalky white carbonate zone that is in the Zita soils.

Profile of Amarillo fine sandy loam in a cultivated field, 3 miles north and 2 miles west of Levelland, 800 feet south and 100 feet east of the northwest corner of labor 23, league 732—

A1p—0 to 10 inches, reddish-brown (5YR 5/4) fine sandy loam, dark reddish brown (5YR 3/4) when moist; weak, granular structure; soft when dry and very friable when moist; noncalcareous; abrupt boundary.

B2—10 to 26 inches, reddish-brown (5YR 4/3) sandy clay loam, dark reddish brown (5YR 3/3) when moist; moderate, very coarse, prismatic structure and moderate, medium, subangular blocky structure; very hard when dry and friable when moist; thin, continuous clay films; common worm casts; many very fine pores; noncalcareous; gradual boundary.

B3—26 to 54 inches, yellowish-red (5YR 5/6) sandy clay loam, (5YR 4/6) when moist; moderate, very coarse, prismatic structure; very hard when dry and friable when moist; common, very fine pores; films and threads of $CaCO_3$ in lower 7 inches; weakly calcareous in lower 7 inches; abrupt boundary.

Cca—54 to 74 inches, pink (5YR 7/4) sandy clay loam, light reddish brown (5YR 6/4) when moist; slightly hard when dry and friable when moist; estimated 40 percent $CaCO_3$, of which 20 percent is small, hard concretions; very strongly calcareous; diffuse boundary.

C—74 to 80 inches +, pink (5YR 7/4) sandy clay loam, light reddish brown (5YR 6/4) when moist; slightly hard when dry and friable when moist; estimated 20 percent soft $CaCO_3$; very strongly calcareous.

Range in characteristics.—Thickness of the A horizon in the fine sandy loam and loam types ranges from 6 to 14 inches, and in the loamy fine sand type, from 8 to 16 inches. Color ranges from reddish brown (5YR 4/3) to brown (7.5YR 5/4) when dry.

Thickness of the B2 horizon ranges from 12 to 25 inches. The color of this horizon is reddish brown, hue 5YR, value 4 to 5, and chroma 3 to 4. Structure ranges from very coarse, prismatic to moderate, medium, subangular blocky. Texture of the B2 horizon is sandy clay loam.

Thickness of the B3 horizon ranges from 10 to 45 inches. Color ranges from red (2.5YR 4/6) to yellowish red (5YR 5/8) when dry. Texture is sandy clay loam. Structure ranges from very coarse, prismatic to weak, subangular blocky.

The Cca horizon occurs at a depth of 28 to 84 inches. Thickness ranges from 15 to 25 inches. Color ranges from pink (5YR 8/3) to reddish yellow (5YR 7/6) when dry. Many fine to medium, segregated, hard and soft $CaCO_3$ concretions occur in this horizon. The $CaCO_3$ equivalent is 30 to 60 percent. Indurated caliche occurs below 36 inches in some places where this soil is associated with Arvana soils.

Arch series

The Arch series consists of nearly level, light-gray to grayish-brown, limy Calcisols. They have developed in Pleistocene sediments of chalky earths that were apparently modified by deposition of $CaCO_3$ from ground water.

The Arch soils are not extensive in this county and occur mostly in the north-central and northwestern parts.

The Arch soils are lighter colored and less deep than the Portales. They are lighter colored and have a grayer substratum than the Mansker soils. The Arch soils are less sloping than the Drake soils and have a horizon of calcium accumulation that is not in the Drake soils. They are lighter colored than the Church soils and have a less clayey subsoil.

Profile of Arch clay loam in a cultivated field, 3 miles west of Pep, 1,000 feet west and 100 feet north of the southeast corner of labor 16, league 699—

A1p—0 to 8 inches, gray (10YR 6/1) clay loam, grayish brown (10YR 5/2) when moist; weak, granular structure; hard when dry and friable when moist; strongly calcareous; clear boundary.

AC—8 to 19 inches, light-gray (10YR 7/1) clay loam, gray (10YR 6/1) when moist; weak, coarse, prismatic structure; hard when dry and friable when moist; few worm casts; common, fine and very fine pores; strongly calcareous; clear boundary.

Cca—19 to 43 inches, white (10YR 8/1) clay loam, light gray (10YR 7/1) when moist; porous, unconsolidated, limy material; hard when dry and firm when moist; common, fine and medium pores; approximately 50 percent $CaCO_3$; very strongly calcareous; gradual boundary.

C—43 to 50 inches +, gray (10YR 6/1) clay loam, gray (10YR 5/1) when moist; unconsolidated limy material containing appreciably less $CaCO_3$ than horizon above; hard when dry and friable when moist; strongly calcareous.

Range in characteristics.—The A horizon ranges in thickness from 6 to 12 inches and in color from grayish brown (10YR 5/2) to light gray (10YR 7/2). Texture

ranges from loam to clay loam. Under sod, this horizon generally has a moderate, medium to fine, subangular blocky structure.

Thickness of the AC horizon ranges from 8 to 18 inches. Color ranges from light brownish gray (10YR 6/2) to light gray (10YR 6/1) or light gray (10YR 7/1 or 10YR 7/2). Texture is generally clay loam. Structure of this horizon ranges from weak, coarse, prismatic to moderate, medium, subangular blocky.

Depth to the Cca horizon ranges from 14 to 30 inches, and thickness of the Cca ranges from 12 to 30 inches. Color ranges from light gray (10YR 7/1) to white (10YR 8/1). Texture is clay loam.

The C horizon, or parent material, is clay loam that is light gray (10YR 6/1) or very pale brown (10YR 7/3) and is several feet thick.

Arvana series

The Arvana series consists of moderately sandy Reddish Chestnut soils of medium depth over indurated caliche. These soils probably developed in a thin, eolian mantle deposited over preexisting caliche. They occur in the northwestern part of the county in nearly level to gently sloping areas. Arvana soils are well drained internally and are moderately permeable. The deep and shallow phases of the fine sandy loam type occur in Hockley County.

The Arvana soils are similar to the Amarillo soils but have less depth. They are redder and have a harder caliche layer than the Portales or Mansker soils and are noncalcareous. They are deeper than the very shallow Kimbrough or Potter soils.

Profile of Arvana fine sandy loam in a cultivated field, 3 miles south and 2 miles west of Pep, 1,500 feet south and 30 feet east of northwest corner of labor 16, league 702—

A1p—0 to 8 inches, dark-brown (7.5YR 4/3) fine sandy loam, (7.5YR 3/3) when moist; structureless; soft when dry, very friable when moist; noncalcareous; abrupt, plow-slice boundary.

B2—8 to 20 inches, reddish-brown (5YR 4/4) sandy clay loam, dark reddish brown (5YR 3/4) when moist; weak, very coarse, prismatic structure; very hard when dry and friable when moist; thin, continuous clay films; common worm casts; many fine pores; noncalcareous; clear boundary.

B3—20 to 30 inches, yellowish-red (5YR 5/6) sandy clay loam, reddish brown (5YR 5/4) when moist; weak, very coarse, prismatic structure, very hard when dry and friable when moist; few worm casts; weakly calcareous in lower 3 inches because of films and threads of $CaCO_3$; abrupt boundary.

Drca—30 inches +, indurated caliche, 1 or 2 feet thick over softer caliche.

Range in characteristics.—Color of the A horizon ranges from brown (7.5YR 5/4) to reddish brown (5YR 4/4) when dry. Texture of this horizon is fine sandy loam, but in some areas finer particles have been removed and, as a result, the texture is light fine sandy loam. Thickness ranges from 6 to 12 inches.

Thickness of the B2 horizon ranges from 10 to 16 inches. Color is reddish brown, hue 5YR, value 4 to 5, and chroma 3 to 4. Structure ranges from very coarse, prismatic to compound, coarse, prismatic and weak, medium, subangular blocky. Texture is sandy clay loam.

Thickness of the B3 horizon ranges from 0 to 15 inches. Color ranges from yellowish red (5YR 5/6) to yellowish red (5YR 4/6) when dry. Texture is sandy clay loam. Structure is weak, very coarse, prismatic.

The indurated caliche layer grades to a softer caliche within 10 to 30 inches. This layer occurs at a depth of 10 to 36 inches from the surface.

Berthoud series

The soils in the Berthoud series are brown, calcareous Regosols that are moderately fine textured, moderately sloping, and moderately deep. They have developed in loamy local alluvium that came from uplands of the Ogallala formation. These soils occur where the normal level high plains are dissected, mainly in the north-central part of the county and along the small watercourses. Loam is the only Berthoud soil type in Hockley County.

The Berthoud soils are grayer and less deep than the Amarillo soils. They are deeper than the Mansker soils and more sloping than the Portales soils. The Berthoud soils are more sloping than the Bippus soils and have a thinner, lighter colored A horizon.

Profile of Berthoud loam in rangeland, 15 miles southwest of Levelland, 900 feet east and 100 feet north of the southwest corner of labor 25, league 52—

A1—0 to 9 inches, grayish-brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) when moist; weak, coarse, prismatic and weak, granular structure; soft when dry and very friable when moist; plentiful roots; few worm casts; strongly calcareous; clear boundary.

AC—9 to 20 inches, brown (10YR 5/3) sandy clay loam, dark brown (10YR 4/3) when moist; weak, coarse, prismatic and moderate, medium, granular structure; slightly hard when dry and friable when moist; few, fine to medium, hard $CaCO_3$ concretions; many worm casts; strongly calcareous; gradual boundary.

Cca—20 to 50 inches +, pale-brown (10YR 6/3) sandy clay loam, brown (10YR 5/3) when moist; common, fine, hard, white $CaCO_3$ concretions; very strongly calcareous.

Range in characteristics.—Thickness of the A horizon ranges from 6 to 12 inches. Color ranges from brown to grayish brown, hue 7.5YR and 10YR. Structure is weak, coarse, prismatic and weak granular. Texture ranges from loam to fine sandy loam.

Thickness of the AC horizon ranges from 10 to 30 inches. Color ranges from brown to pale brown, hue 7.5YR and 10YR. Texture is sandy clay loam. Structure is weak to moderate and is generally coarse, prismatic or medium, granular. This soil is porous and friable.

Depth to the Cca horizon ranges from 16 to 42 inches. Color ranges from pink to pale brown, hue 7.5YR and 10YR. Texture is sandy clay loam.

Bippus series

The Bippus series consists of dark, gently sloping Chestnut soils. They have developed in strongly calcareous alluvium of clay loam texture. They are in concave, lower positions or alluvial fans where the level high plains are deeply dissected.

The Bippus soils have a thicker, darker A horizon than the Berthoud soils and are less sloping. They are darker than the Portales soils and more sloping than the Spur soils.

The Bippus soils occur only in the north-central part of the county and in the floors of drainageways. They are not extensive.

Profile of Bippus clay loam in rangeland, 10 miles north and 5 miles west of Levelland, 1,000 feet southwest of the northeast corner of labor 3, league 704—

A1—0 to 22 inches, dark-brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) when moist; moderate, medium, granular and subangular blocky structure; very hard when dry and friable when moist; many worm casts; noncalcareous; clear boundary.

AC—22 to 46 inches, pale-brown (10YR 6/3) clay loam, dark brown (10YR 4/3) when moist; moderate, medium, granular structure; very hard when dry and friable when moist; few, fine, soft, calcium carbonate concretions; few worm casts; strongly calcareous; clear boundary.

C—46 to 55 inches +, pinkish-gray (7.5YR 7/2) clay loam, (7.5YR 6/2) when moist; unconsolidated material containing common, soft, large, white calcium carbonate concretions; very strongly calcareous.

Range in characteristics.—Thickness of the A horizon ranges from 14 to 28 inches. Texture ranges from clay loam to sandy clay loam and may range to loam in upper part. Where the upper part is loam, a 6- to 10-inch A11 horizon of the same color occurs. Color ranges from brown to dark grayish brown to dark brown, hue 7.5YR and 10YR, value 3 to 4, and chroma 2 to 3. Structure ranges from moderate, medium, granular to moderate, fine, subangular blocky.

Thickness of the AC horizon ranges from 15 to 35 inches, and texture, from sandy clay loam to clay loam. Color ranges from pale brown or light brown to brown, hue 7.5YR and 10YR, value 5 to 6, and chroma 2 to 3. Structure ranges from weak, prismatic to moderate, medium, subangular blocky.

The C horizon occurs at a depth of about 29 to 63 inches. Color of the C horizon ranges from pink or very pale brown to light brown or pale brown, hue 7.5YR and 10YR, value 6 to 7, and chroma 3 or 4. Texture ranges from sandy clay loam to clay loam.

The A horizon is normally noncalcareous, and the AC and C horizons are calcareous.

Brownfield series

The Brownfield series consists of deep, brown, sandy soils that are noncalcareous and gently undulating. These soils are in the Reddish Brown great soil group. They have 18 to 36 inches of fine sand overlying a red or reddish-brown, friable subsoil of sandy clay loam. They have developed in eolian sandy earths and normally do not have a horizon of calcium accumulation.

The Brownfield soils are sandier than the Amarillo soils, are redder and sandier than the Portales soils, and have a more clayey subsoil than the Tivoli soils. They are redder and sandier and have a less limy substratum than Zita soils.

Brownfield soils are not extensive in Hockley County. They occur in only two small areas.

Profile of Brownfield fine sand, 10 miles north of Levelland, 400 feet north of the southeast corner of labor 23, league 708—

A1—0 to 6 inches, brown (10YR 5.5/3) fine sand, dark brown (10YR 4/3) when moist; structureless (single grain); loose when dry and when moist; many fine roots; noncalcareous; clear boundary.

A2—6 to 22 inches, pale-brown (10YR 6/3) fine sand, dark brown (10YR 4/3) when moist; structureless (single grain); loose when dry and when moist; noncalcareous; abrupt boundary.

B2—22 to 37 inches, reddish-brown (5YR 5/4) sandy clay loam, dark reddish brown (5YR 3/4) when moist; compound, moderate, very coarse, prismatic structure and moderate, medium, subangular blocky structure; very hard when dry and friable when moist; noncalcareous; clear boundary.

D—37 to 60 inches +, pink (5YR 8/3) sandy clay loam, (5YR 7/3) when moist; strongly calcareous.

Range in characteristics.—Thickness of the A1 horizon ranges from 4 to 8 inches. Color ranges from 7.5YR to 10YR in hue, 5 to 6 in value, and 3 to 4 in chroma. Texture is fine sand. This layer is structureless (single grain).

The A2 horizon ranges from 8 to 20 inches in thickness. Color ranges from 7.5YR to 10YR in hue, 5 to 7 in value, and 3 to 4 in chroma. The texture is fine sand. This layer is structureless (single grain).

The B2 horizon ranges from 10 to 20 inches in thickness. Color ranges from 2.5YR to 5YR in hue, 4 to 5 in value, and 4 to 6 in chroma. Texture is sandy clay loam. Structure ranges from weak, coarse, prismatic to moderate, medium, subangular blocky.

A sandy clay loam or fine sandy loam B3 horizon 30 to 40 inches thick is present in places. Color of this horizon ranges from 2.5YR to 5YR in hue, 4 to 6 in value, and 4 to 6 in chroma. Structure is weak, coarse, prismatic.

A strongly calcareous D layer, several feet thick, occurs in many places. Color ranges from pink to very pale brown, hue 5YR to 10YR. Texture is sandy clay loam.

Some areas of Brownfield soils, especially in the southwestern part of the county, have a yellowish-red fine sandy loam C horizon several feet thick.

Church series

The Church series consists of nearly level, limy, grayish-brown, slowly permeable Calcisols. They have developed on thick, limy, gray clay beds in low positions. These soils are in a broad flat area, west and south of Yellow Lake in the northwestern part of the county, and adjacent to a few playa lakes, mainly in the eastern part of the county.

The Church soils are lighter colored than the Randall soils and occupy higher positions. They are slightly darker than the Arch soils and have a more clayey subsoil. They have less depth and a more clayey subsoil than the Portales soils. The Church soils occupy lower positions and have a more clayey subsoil than the Drake soils.

Profile of Church clay loam in rangeland, 17 miles north of Levelland, 0.8 mile north of the Yellow House ranch headquarters—

A1—0 to 6 inches, grayish-brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) when moist; strong, fine and medium, subangular blocky structure; hard when dry and firm when moist; many fine pores; strongly calcareous; clear boundary.

AC—6 to 18 inches, light brownish-gray (10YR 6/2) clay loam, grayish brown (10YR 5/2) when moist; strong, fine and medium, subangular blocky and blocky structure; very hard when dry and firm when moist; common, fine, hard concretions; few worm casts; few pores; strongly calcareous; clear boundary.

Cca—18 to 30 inches, light-gray (2.5Y 7/1) clay, light brownish gray (2.5Y 6/2) when moist; strong, fine, blocky structure; very hard when dry and firm when moist; roots follow ped faces; very strongly calcareous; gradual boundary.

C—30 to 40 inches +, gray (2.5Y 6/1) clay, light brownish gray (2.5Y 6/2) when moist; strong, fine, blocky structure; very hard when dry and firm when moist; few gypsum crystals; very strongly calcareous.

Range in characteristics.—The A1 horizon ranges in thickness from 3 to 8 inches and in color from dark grayish brown (10YR 4/2) or (2.5Y 4/2) to gray (10YR 5/1) or (2.5Y 5/1). Texture is generally clay loam. Structure ranges from moderate, fine, granular to moderate, fine, subangular blocky.

Thickness of the AC horizon ranges from 8 to 20 inches. Color ranges from grayish brown (10 YR 5/2) or (2.5Y 5/2) to light gray (10YR 7/1) or (2.5Y 7/1). Structure ranges from moderate, medium, subangular blocky to strong, fine, blocky. Texture ranges from clay loam to clay.

The Cca horizon occurs at a depth of 11 to 28 inches. Thickness ranges from 7 to 18 inches. Color ranges from light gray (10YR 7/1) or (2.5Y 7/1) to white (10YR 8/1) or (2.5Y 8/1). Texture is clay. Structure is generally strong, fine blocky.

The parent material, or C horizon, is a clay-textured material that is light gray (10YR 6/1), (2.5Y 6/1), (10YR 7/1), or (2.5Y 7/1). This material is several feet thick.

Drake series

The Drake series consists of gently sloping to sloping, grayish-brown, shallow, limy Regosols. They have developed in low dunes of limy, gray, eolian material. Although not extensive, they occur in all parts of the county.

The Drake soils are lighter in color and less deep than the Portales soils, and do not have a ca horizon. They have a grayer, more limy substratum than the Mansker soils. The Drake soils do not have a Cca horizon and are more sloping than the Arch or Church soils.

Profile of Drake loam in rangeland, 2 miles south and 1½ miles east of Levelland, 1,400 feet west and 100 feet north of the southeast corner of labor 10, league 29—

A1—0 to 8 inches, grayish-brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) when moist; weak, very coarse, prismatic structure; slightly hard when dry and friable when moist; many fine pores; few worm casts; strongly calcareous; clear boundary.

AC—8 to 15 inches, light brownish-gray (10YR 6/2) clay loam, grayish brown (10YR 5/2) when moist; weak, very coarse, prismatic structure; hard when dry and friable when moist; many fine pores; common worm casts; very strongly calcareous; gradual boundary.

C—15 to 60 inches +, light-gray (10YR 7/2) clay loam, light brownish gray (10YR 6/2) when moist; very limy, porous material; hard when dry and friable when moist.

Range in characteristics.—Thickness of the A1 horizon ranges from 6 to 10 inches. Color ranges from brown to light brownish gray, hue 10YR, value 5 to 6, and chroma 2 to 3. Texture ranges from fine sandy loam to clay loam. Structure ranges from weak, very coarse, prismatic to weak, medium granular.

The AC horizon ranges in thickness from 0 to 10 inches. It may be absent, especially on steeper slopes. Color ranges from grayish brown to light brownish gray, hue 10YR, value 5 or 6, and chroma 2. Texture ranges from clay loam to loam. Structure of this horizon ranges from weak, very coarse prismatic to weak, coarse granular.

The C horizon is at a depth of 6 to 20 inches. Color ranges from light gray to white, hue 10YR, value 7 to 8, and chroma 1 to 2. Texture ranges from clay loam to loam.

Kimbrough series

The Kimbrough series consists of very shallow, dark grayish-brown, well-drained soils underlain by indurated caliche. They have developed from a thin mantle deposited on the preexisting platy, stonelike caliche. These soils are inextensive and occur in the northern part of the county.

The Kimbrough soils are darker and thinner than the Arvana soils. They are less clayey and thinner than the Stegall soils. The Kimbrough soils are less sloping than the Potter soils and are underlain by harder caliche.

Profile of Kimbrough loam in rangeland, 2 miles south and 3½ miles east of Pep, 1,500 feet west and 150 feet south of the northeast corner of labor 7, league 704—

A1—0 to 7 inches, dark grayish-brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) when moist; strong, medium, granular structure; slightly hard when dry and very friable when moist; noncalcaleous; abrupt boundary.

Dr—7 inches +, indurated caliche.

Range in characteristics.—Thickness of the A horizon ranges from 2 to 10 inches. Color ranges from brown to dark grayish brown, hue 7.5YR and 10YR, value 4 to 5, and chroma 2 to 3. Texture ranges from loam to fine sandy loam. Structure ranges from strong, medium granular to moderate, coarse, subangular blocky. This layer is noncalcareous.

The Dr layer of stonelike caliche is usually 2 to 3 feet thick over softer caliche.

Lea series

The Lea series consists of nearly level soils that are shallow, grayish brown, and calcareous and are underlain by indurated caliche. They have developed from a moderately fine textured mantle deposited over preexisting caliche. In Hockley County the Lea series occurs only in a complex with the Stegall series and is only in the northwestern part of the county. Only the shallow phase of Lea soils occurs in this county.

The Lea soils are thinner than the Portales soils and have a harder caliche substratum. They are grayer than Arvana soils and thicker than the Kimbrough soils. Lea soils have a harder caliche substratum than the Mansker soils; and they are grayer and have a less compact subsoil than the Stegall soils.

Profile of Lea loam, 1 mile west of Pep, 1,500 feet west and 200 feet south of the northeast corner of labor 4, league 699—

A1p—0 to 6 inches, dark grayish-brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) when moist; structureless plow layer; slightly hard when dry and very friable when moist; few, medium and fine, hard, irregular $CaCO_3$ concretions; strongly calcareous; abrupt boundary.

A12—6 to 12 inches, grayish-brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) when moist; strong, medium, subangular blocky structure; hard when dry and friable when moist; many worm casts; common, medium, and fine, hard, irregular $CaCO_3$ concretions and fragments; strongly calcareous; clear boundary.

AC—12 to 17 inches, brown (10YR 5.5/3) clay loam, dark brown (10YR 4/3) when moist; moderate, medium, subangular blocky structure; hard when dry and friable when moist; many worm casts; common, medium to fine, hard, irregular $CaCO_3$ concretions; very strongly calcareous; abrupt boundary.

Drca—17 inches +, indurated caliche.

Range in characteristics.—Thickness of the A1p horizon ranges from 4 to 8 inches; color from dark grayish brown (10YR 4/2) to brown (10YR 5/3); and texture, from loam to clay loam. Structure of this horizon in sod ranges from strong, medium, granular to moderate, coarse, subangular blocky. This horizon is calcareous in places.

The A12 horizon ranges from 0 to 10 inches. This horizon may be absent if depth to indurated caliche is 10 to 12 inches. Color of this horizon ranges from brown (10YR 5/3) or grayish brown to pale brown (10YR 6/3). Texture is clay loam. Structure ranges from moderate, medium, prismatic to strong, fine subangular blocky. This horizon is normally calcareous.

The AC horizon is 4 to 10 inches thick. Color ranges from brown (10YR 5/3) to pale brown (10YR 6/3). Structure ranges from moderate, coarse prismatic to strong, medium, subangular blocky. Texture is clay loam. The AC horizon is strongly or very strongly calcareous.

Depth to the indurated caliche ranges from 8 to 28 inches.

Mansker series

The Mansker series consists of grayish-brown to brown, moderately shallow Calcisols that have developed in strongly calcareous, fine-textured, alluvial and eolian deposits.

The Mansker soils occur throughout the county in small areas. Their slopes range from 0 to 5 percent.

The Mansker soils are grayer and thinner than the Amarillo soils and are calcareous. They are grayer than the Arvana soils and have a softer caliche substratum. They are thinner than the Portales soils, and are thicker than the Potter and Kimbrough soils.

Profile of Mansker fine sandy loam in a cultivated field, 12 miles north and 5 miles east of Levelland, 500 feet east and 200 feet north of the southwest corner of labor 16, league 692—

A1p—0 to 8 inches, brown (10YR 5/3) fine sandy loam, dark brown (10YR 3/3) when moist; structureless plow layer; soft when dry and very friable when moist; weakly calcareous; abrupt boundary.

AC—8 to 17 inches, brown (10YR 5/3) sandy clay loam, dark brown (10YR 4/3) when moist; weak, coarse, prismatic structure; slightly hard when dry and friable when moist; few worm casts; common fine pores; common, fine and medium, hard $CaCO_3$ concretions; strongly calcareous; abrupt boundary.

Cca—17 to 30 inches, very pale brown (10YR 7/3) sandy clay loam, pale brown (10YR 6/3) when moist; mass of pink earth, of which approximately 50 percent is hard and soft, medium to large $CaCO_3$ concretions; very strongly calcareous; gradual boundary.

C—30 to 40 inches +, pink (7.5YR 7/4) sandy clay loam, light brown (7.5YR 6/4) when moist; unconsolidated material; slightly hard when dry and friable when moist; very strongly calcareous.

Range of characteristics.—Thickness of the A1p ranges from 5 to 11 inches. Color ranges from brown, hue 7.5YR and 10YR, value 4 or 5, and chroma 3, to grayish brown (10YR 5/2). Structure, under sod, is weak, coarse prismatic. Texture ranges from loam to fine sandy loam.

The AC horizon ranges in thickness from 4 to 15 inches. Color ranges from brown, hue 7.5YR and 10YR, value 5, chroma 3 or 4, to pale brown (10YR 6/3) or light brown (7.5YR 6/4). Texture ranges from sandy clay loam to clay loam. Structure ranges from weak, coarse prismatic to moderate, coarse, subangular blocky.

Depth to the Cca horizon ranges from 9 to 26 inches. Thickness ranges from 8 to 30 inches. Color is generally pink (7.5YR 7/4) or very pale brown (10YR 7/3). Texture ranges from sandy clay loam to clay loam. At times this horizon is somewhat cemented.

The C horizon is sandy clay loam or clay loam material that is pink (7.5YR 7/4) or pale brown (10YR 6/3) and several feet thick.

Olton series

The Olton series consists of nearly level Reddish Chestnut soils that are deep and reddish brown to brown and have a compact subsoil. They have developed in unconsolidated, calcareous, alluvial and eolian, clay loam materials. This series is most common in the eastern part of the county. Surface drainage is slow, and the soils are slowly permeable.

The Olton soils have a more clayey, compact subsoil than the Amarillo soils. They are deeper and redder than the Mansker soils. The Olton soils are redder and have a more compact subsoil than the Portales soils and Zita soils.

Profile of Olton loam, 3 miles south and 1 mile east of Smyer, 400 feet north and 50 feet east of the southwest corner of labor 11, league 4—

Ap—0 to 7 inches, dark-brown (7.5YR 4/2) loam, (7.5YR 3/2) when moist; weak, granular structure; slightly hard when dry and friable when moist; noncalcareous; abrupt boundary.

B21—7 to 12 inches, dark-brown (7.5YR 4/2) clay loam, (7.5YR 3/2) when moist; moderate, fine, subangular blocky structure; hard when dry and firm when moist; many very fine pores; few worm casts; noncalcareous; clear boundary.

B22—12 to 24 inches, reddish-brown (5YR 4/3) heavy clay loam, dark reddish brown (5YR 3/3) when moist; moderate, fine, blocky structure; hard when dry and firm when moist; few very fine pores; thin, patchy clay films; noncalcareous; clear boundary.

B3—24 to 38 inches, reddish-brown (5YR 3/3) clay loam, (5YR 4/4) when moist; moderate, fine to medium, subangular blocky and blocky structure; hard when dry and firm when moist; films and threads of $CaCO_3$ in lower part; strongly calcareous; abrupt boundary.

Cca—38 to 56 inches, pink (5YR 7/4) clay loam, light reddish brown (5YR 6/4) when moist; very strongly calcareous, unconsolidated material; slightly hard when dry and friable when moist; common, soft and hard $CaCO_3$ concretions; diffuse boundary.

C—56 to 70 inches +, reddish-yellow (5YR 7/6) light clay loam, (5YR 6/6) when moist; slightly hard when dry and friable when moist; few, fine $CaCO_3$ concretions; very strongly calcareous.

Range in characteristics.—The Ap horizon ranges from 4 to 10 inches in thickness, from dark brown (7.5YR 4/2) to reddish brown (5YR 4/3) in color, and from loam to clay loam in texture.

The B21 horizon ranges from 4 to 15 inches in thickness and from dark brown (7.5YR 4/2) to reddish brown (5YR 4/3) in color. The texture is clay loam. Structure ranges from weak, fine, subangular blocky to moderate, medium blocky.

The heavy clay loam B22 horizon ranges from 10 to 20 inches in thickness and from reddish brown (5YR 4/4) to brown (7.5YR 4/4) in color. It has moderate to strong, medium and fine, blocky structure.

Color of the B33 horizon ranges from strong brown (7.5YR 5/6) to reddish brown (5YR 5/4) to reddish yellow (5YR 6/6). Thickness ranges from 6 to 20 inches.

Texture is clay loam. Structure of this horizon ranges from weak to moderate, fine and medium, subangular blocky or blocky.

Depth to the Cca horizon ranges from 30 to 50 inches. This horizon may be indistinct or may be as thick as 30 inches. Color is pink (5YR 7/4) or (7.5YR 7/4). Texture is clay loam. This horizon may contain as much as 50 percent soft or hard $CaCO_3$ concretions.

The C horizon ranges in color from reddish yellow (5YR 6/6) or light reddish brown (5YR 6/4) to pink (5YR 7/4). Texture ranges from clay loam to sandy clay loam.

Portales series

The Portales series consists of nearly level to gently sloping Calcisols that are moderately deep and grayish brown. They have developed in limy plains sediments and occur throughout the county. They are most common in the playa lake area.

Fine sandy loam and loam are the two types of soil in the Portales series. These soils are grayer and less deep than the Amarillo soils and are calcareous. They are grayer and have a softer substratum than the Arvana soils and are calcareous. The Portales soils are deeper than the Mansker soils. They are less limy and are deeper than the Arch or Church soils.

Profile of Portales fine sandy loam in cultivated field, 1 mile south and 1½ miles east of Levelland, 300 feet east and 50 feet south of the northwest corner of labor 26, league 27—

A1p—0 to 8 inches, grayish-brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) when moist; fine granular structure; soft when dry and very friable when moist; few, fine and medium, hard $CaCO_3$ concretions; weakly calcareous; abrupt, plow-slice boundary.

A12—8 to 16 inches, grayish-brown (10YR 5/2) sandy clay loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, granular structure; slightly hard when dry and friable when moist; many worm casts; many very fine pores; few, fine to medium $CaCO_3$ concretions; very strongly calcareous; clear boundary.

AC—16 to 34 inches, light brownish-gray (10YR 6/2) clay loam, grayish brown (10YR 5/2) when moist; moderate, medium, prismatic structure; hard when dry and friable when moist; few worm casts; few, fine and medium, hard $CaCO_3$ concretions; strongly calcareous; diffuse boundary.

Cca—34 to 60 inches, white (10YR 8/1) clay loam, light gray (10YR 7/2) when moist; very strongly calcareous material containing approximately 50 to 60 percent $CaCO_3$; common, hard, white, medium and fine $CaCO_3$ concretions; gradual boundary.

C—60 to 65 inches +, very pale brown (10YR 8/3) clay loam, (10YR 7/3) when moist; unconsolidated, very strongly calcareous material containing less $CaCO_3$ than horizons above.

Range in characteristics.—Thickness of the Alp horizon ranges from 5 to 10 inches. Color ranges from brown (10YR 5/3) or (7.5YR 5/4) to grayish brown (10YR 5/2) or brown (7.5YR 5/2). Texture ranges from loam to fine sandy loam. The structure of this horizon, under sod conditions, ranges from weak, granular to weak, medium, subangular blocky.

The A12 horizon has the same range in thickness and color as the A1 horizon. The texture is sandy clay loam to clay loam. Structure ranges from weak, coarse, prismatic to moderate, medium, subangular blocky.

Thickness of the AC horizon ranges from 10 to 35 inches. Color of this horizon ranges from hue 7.5YR and 10YR, value 4 to 5, and chroma 2 to 3. Texture ranges from sandy clay loam to clay loam. Structure of the AC horizon ranges from moderate, medium to weak, coarse, prismatic.

Depth to the Cca horizon ranges from 20 to 55 inches, and thickness of this horizon ranges from 10 to 30 inches. The color is 10YR in hue, 7 to 8 in value, and 1 to 2 in chroma. Texture ranges from sandy clay loam to clay loam. Where associated with Arvana soils, Portales soils may have a layer of indurated caliche under the AC or Cca horizons.

The C horizon, or parent material, is pink or very pale-brown clay loam several feet thick.

Potter series

The Potter series is comprised of very shallow, grayish-brown, calcareous, sloping Lithosols. They have developed from thick beds of soft or weakly cemented caliche material that is generally more than 50 percent $CaCO_3$. Slopes range from 3 to 20 percent but are generally 5 to 8 percent. These soils are of minor extent and occur mainly in the north-central part of the county.

The Potter soils have a softer caliche substratum than the Kimbrough soils. They have less depth than the Mansker and Berthoud soils.

Profile of Potter loam in rangeland, 10 miles north and 5 miles west of Levelland, 1,500 feet west and 500 feet north of the southeast corner of labor 21, league 704—

A1—0 to 7 inches, grayish-brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) when moist; moderate, medium, subangular blocky structure; slightly hard when dry and friable when moist; many, fine to medium, hard caliche fragments; very strongly calcareous; clear boundary.

C—7 to 20 inches +, pinkish-white (7.5YR 8/2) sandy clay loam, (7.5YR 7/2) when moist; approximately 50 percent of material consists of soft and hard, medium to coarse $CaCO_3$ concretions; very strongly calcareous.

Range in characteristics.—Thickness of the A horizon ranges from 4 to 10 inches. Color of this horizon ranges from brown to grayish brown, hue 7.5YR and 10YR, value 4 to 5, and chroma 2 to 3. Texture ranges from loam to fine sandy loam. Structure ranges from moderate, medium, granular to moderate, coarse, subangular blocky.

The parent material ranges in color from light brown to pink to white, hue 7.5YR and 10YR, value 6 to 8, and chroma 2 to 3. In places a few inches of this horizon are weakly to strongly cemented.

Randall series

The Randall series consists of level, deep, dark-gray, poorly drained soils of the playas. These soils have developed under wet conditions from unconsolidated, fine-textured, late Pleistocene sediments. Randall soils are in small areas in all parts of the county.

Randall soils are darker and deeper than Church soils and in lower positions. They are more poorly drained than the Zita or Amarillo soils and are much more clayey.

Profile of Randall clay, 1 mile south and ½ mile west of Levelland, 1,000 feet north of the southwest corner of labor 4, league 29—

A1p—0 to 8 inches, dark-gray (10YR 4/1) clay, very dark gray (10YR 3/1) when moist; moderate, fine, blocky

structure; hard when dry, firm when moist, and slightly sticky and plastic when wet; few lenses of loam or fine sandy loam noted; noncalcareous; abrupt boundary.

A12—8 to 20 inches, dark-gray (10YR 4/1) clay, very dark gray (10YR 3/1) when moist; strong, fine, blocky structure; very hard when dry, firm when moist, and slightly sticky and plastic when wet; noncalcareous; clear boundary.

AC—20 to 38 inches, gray (10YR 5/1) clay, dark gray (10YR 4/1) when moist; massive structure; extremely hard when dry, very firm when moist, and slightly sticky and plastic when wet; strongly calcareous, few, fine, hard, white $CaCO_3$ concretions; gradual boundary.

C—38 to 45 inches +, gray (10YR 6/1) clay, (10YR 5/1) when moist; massive structure; extremely hard when dry, very firm when moist; and slightly sticky and plastic when wet; few, fine to medium, hard, white $CaCO_3$ concretions; strongly calcareous.

Range in characteristics.—Thickness of the A horizon is generally about 20 inches. Color of this horizon ranges from black to very dark grayish brown, hue 10YR, value 2 to 4, and chroma 1 or 2. Texture of the Alp horizon ranges from fine sandy loam to clay. Where the texture is fine sandy loam, the thickness of the Alp ranges from 8 to 20 inches and the color is brown. Structure of the A horizon is commonly strong, fine, blocky. This horizon may or may not be calcareous.

The AC horizon is about 20 inches thick. Color ranges from dark gray to light gray, hue 10YR, value 4 to 6, and chroma 1. Texture is clay. Structure ranges from moderate, medium, blocky to massive. This horizon may or may not be calcareous.

Depth to the C horizon averages about 40 inches. Color ranges from gray to light gray, hue 10YR, value 5 to 7, and chroma 1 to 2. This horizon is generally calcareous. It is massive in structure and clay in texture.

Spur series

The Spur series consists of nearly level, brown, friable soils on bottom lands of the small drainageways. These soils have developed in recent calcareous alluvium transported from nearby slopes. They are seldom flooded.

The Spur soils are lighter in color than the similar Bippus soils and are calcareous.

Profile of Spur loam, 2 miles east and 1.5 miles south of Anton, 0.4 of a mile south of the northwest corner of section 100–

A1p—0 to 6 inches, brown (10YR 4/3) loam, dark brown (10YR 3/3) when moist; weak, granular structure; hard when dry and friable when moist; slightly calcareous; abrupt plow-slice boundary.

A12—6 to 24 inches, grayish-brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) when moist; compound, weak, coarse, prismatic and moderate, medium, granular structure; very hard when dry and friable when moist; many worm casts; many fine pores; strongly calcareous; diffuse boundary.

AC—24 to 50 inches, pale-brown (10YR 6/3) clay loam, brown (10YR 4/3) when moist; moderate, medium, granular structure; very hard when dry and friable when moist; few worm casts; common fine pores; few, fine, soft calcium carbonate concretions; strongly calcareous; gradual boundary.

C—50 to 60 inches +, gray (10YR 6/1) clay loam, grayish brown (10YR 5/2) when moist; massive (structureless); very hard when dry and firm when moist; common medium calcium carbonate concretions; very strongly calcareous.

Range in characteristics.—The A1p horizon ranges in thickness from 4 to 10 inches and in texture from loam to clay loam. The A1p horizon of the described profile has probably had recent deposits mixed with it. Under virgin conditions the horizon described as the A12 begins at the surface of the soil. Color of this horizon ranges from brown to dark grayish brown to dark brown, hue 7.5YR and 10YR, value 3 to 4, and chroma 2 to 4. Structure of the A1p horizon ranges from structureless to strong, medium, granular.

The A12 horizon ranges in thickness from 12 to 25 inches. Texture is clay loam. Color ranges from gray to dark grayish brown to brown, hue 7.5YR and 10YR, value 4 to 5, and chroma 1 to 2. Structure of this horizon ranges from compound, weak, prismatic and weak, granular to moderate, medium, subangular blocky.

The AC horizon ranges from 15 to 30 inches in thickness. Color ranges from pale brown or light brown to brown, hue 7.5YR and 10YR, value 5 to 6, and chroma 3 to 4. Texture ranges from clay loam to sandy clay loam, and structure, from weak granular to moderate, medium, subangular blocky.

The C horizon or parent material occurs at a depth of about 31 to 65 inches. Color ranges from gray to light brownish gray to light brown, hue 7.5YR and 10YR, value 5 to 6, and chroma 1 to 2. Texture ranges from sandy clay loam to clay loam.

The entire profile is normally calcareous. In some places stratification of lighter textured materials was observed. At times the Spur soils rest on a very strongly calcareous, limy, white or light-gray material, thought to be a D horizon.

Stegall series

The Stegall series is comprised of nearly level, shallow to moderately deep, brown to reddish-brown Chestnut soils underlain by indurated caliche. They have developed in a moderately fine textured eolian mantle deposited over preexisting caliche. These soils are in two or three small areas in the northwestern part of the county. Only the shallow phase of the Stegall series occurs in this county.

The Stegall soils have a more clayey, compact subsoil than the Arvana soils. They have less depth and a harder caliche substratum than the Amarillo soils. The Stegall soils are redder and less deep than Portales soils and are noncalcareous. They are deeper than the Kimbrough soils and they are redder and underlain by harder caliche than the Mansker soils.

Profile of Stegall loam, 1 mile west of Pep, 1,000 feet south and 300 feet west of the northeast corner of labor 14, league 699—

Ap—0 to 7 inches, dark-brown (7.5YR 4/2) loam, (7.5YR 3/2) when moist; structureless; hard when dry and friable when moist; noncalcareous; abrupt boundary.

B21—7 to 14 inches, reddish-brown (5YR 4/4) heavy clay loam, dark reddish brown (5YR 3/4) when moist; compound, moderate, medium, prismatic and strong, medium, blocky structure; hard when dry and friable when moist; thin clay skins; few worm casts; common, very fine pores; noncalcareous; clear boundary.

B22—14 to 18 inches, reddish-brown (5YR 5/4) heavy clay loam, (5YR 4/4) when moist; moderate, medium, blocky structure; hard when dry and friable when moist; common very fine pores; few, fine, soft $CaCO_3$ concretions; weakly calcareous; abrupt boundary.

Drca—18 to 20 inches +, indurated caliche.

Range in characteristics.—Thickness of the Ap horizon ranges from 4 to 8 inches. Color ranges from hue 7.5YR to 10YR, value 4 to 5, and chroma 2 to 3. Texture ranges from loam to clay loam. Structure of this horizon, under sod, ranges from moderate, medium to coarse, subangular blocky.

Thickness of the B21 ranges from 5 to 12 inches. Color ranges from hue 5YR to 7.5YR, value 3 to 4, and chroma 3 to 4. Texture is clay loam or heavy clay loam. Structure of this horizon ranges from moderate, fine, subangular blocky to strong, fine, blocky.

The B22 ranges from 0 to 7 inches in thickness. It may be absent if the depth to indurated caliche is 9 to 14 inches. Color of this horizon ranges from hue 5YR to 7.5YR, value 4 to 5, and chroma 3 to 4. Structure of the B22 ranges from weak, coarse, subangular blocky to moderate, fine, blocky. This horizon is calcareous in places.

Depth to the indurated caliche ranges from 9 to 27 inches. The indurated caliche is several feet thick.

Tivoli series

The Tivoli series consists of deep, loose, pale-brown undulating or duned sands. These soils do not have a textural profile. They occur in only one small area in the north-central part of the county. In this county, Tivoli soils are underlain by red sandy clay loam at a depth of 3 to 15 feet.

Tivoli soils have a sandier subsoil than the Brownfield and Amarillo soils.

Profile of Tivoli fine sand in rangeland, 10 miles north of Levelland, 1,000 feet south and 100 feet east of the northwest corner of labor 4, league 717—

A1—0 to 12 inches, pale-brown (10YR 6/3) fine sand, brown (10YR 5/3) when moist; structureless (single grain); loose when dry and when moist; noncalcareous; gradual boundary.

C—12 to 58 inches, light-brown (7.5YR 6/4) fine sand, brown (7.5YR 5/4) when moist; structureless (single grain); loose when dry and when moist; noncalcareous; abrupt boundary.

A1b—58 to 70 inches, reddish-brown (5YR 5/4) fine sandy loam, (5YR 4/4) when moist; soft when dry and very friable when moist; noncalcareous; abrupt boundary.

B2b—70 to 75 inches +, red (2.5YR 5/8) sandy clay loam, (2.5YR 4/8) when moist; hard when dry and firm when moist; noncalcareous.

Range in characteristics.—Thickness of the A horizon ranges from 4 to 20 inches. Color ranges from brown to very pale brown, hue 10YR, value 5 to 7, and chroma 3. This horizon is structureless (single grain). Texture is fine sand.

The C horizon is structureless fine sand. Color ranges from yellowish brown to light brown, hue 7.5YR to 10YR, value 5 or 6, and chroma 4.

Depth to the buried soil ranges from 3 to 15 feet. It is usually a red or reddish-brown sandy clay loam.

Zita series

The Zita series is comprised of nearly level, moderately deep, dark-brown or dark grayish-brown Chestnut soils developed in highly calcareous clay loam. These soils are generally underlain by a distinctly chalky carbonate zone. In many places Zita soils occupy a small, nearly level bench east of playa lakes, but they also occur on broad flats.

Two soil types of the Zita series, loam and fine sandy loam, are mapped in the county. The Zita soils are darker and less deep than the Amarillo soils. They have a less limy A horizon than the Portales soils. They have a darker, thicker A horizon than Mansker soils and are deeper. The Zita soils are darker than the Arvana soils and have a softer substratum. They have a less clayey and compact subsoil than the Olton soils.

Profile of Zita loam, 7 miles east and 1 mile north of Levelland, 400 feet north and 100 feet east of the southwest corner of labor 11, league 735—

A1p—0 to 7 inches, dark grayish-brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) when moist; structureless plow layer; slightly hard when dry and very friable when moist; noncalcareous; abrupt boundary.

A12—7 to 18 inches, dark grayish-brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) when moist; moderate, medium, subangular blocky structure; hard when dry and friable when moist; common worm casts; many very fine and fine pores; noncalcareous; clear boundary.

AC—18 to 24 inches, light brownish-gray (10YR 6/2) clay loam, grayish brown (10YR 5/2) when moist; weak, subangular blocky structure; hard when dry and friable when moist; many fine pores; common worm casts; few, soft, very fine concretions; strongly calcareous; clear boundary.

Cca—24 to 35 inches, white (10YR 8/1) clay loam, light gray (10YR 7/1) when moist; approximately 50 percent $CaCO_3$; many very fine and fine, soft concretions; very strongly calcareous; diffuse boundary.

C—35 to 40 inches +, very pale-brown (10YR 7/3) clay loam, pale brown (10YR 6/3) when moist; very strongly calcareous material containing many fine, soft to hard concretions.

Range in characteristics.—Texture of the A1p horizon ranges from loam to fine sandy loam. Thickness ranges from 4 to 10 inches. Structure and color ranges are the same as in the A12 horizon.

Thickness of the A12 horizon ranges from 6 to 20 inches. Color of this horizon ranges from hues 7.5YR and 10YR, value 3 to 4, and chroma 2 to 3. Texture ranges from sandy clay loam to clay loam. Structure is moderate, medium, subangular blocky.

The strongly calcareous AC horizon ranges from 4 to 10 inches in thickness. Color of this horizon ranges from brown (7.5YR 5/2) or grayish brown (10YR 5/2) to light brownish gray (10YR 6/2). Texture ranges from clay loam to sandy clay loam. Structure of the AC horizon ranges from weak, coarse, prismatic to weak, subangular blocky.

Depth to the Cca horizon ranges from 20 to 40 inches, and the thickness of this horizon ranges from 10 to 30 inches. Color ranges from light gray (10YR 7/2) to white (10YR 8/1). Texture ranges from clay loam to sandy clay loam.

The C horizon ranges in color from pink (7.5YR 7/4) to very pale brown (10YR 7/3).

General Nature of the County

This section describes the climate and geology of the county and relates briefly the county history. It also gives statistics about crops and livestock and information about natural resources, community facilities, farm improvements, transportation, and markets.

TABLE 5.--TEMPERATURE AND PRECIPITATION

Month	Temperature							Precipitation		
	Average			Extremes				Average monthly	Greatest daily	
	Daily maximum	Daily minimum	Monthly	Highest recorded		Lowest recorded				
	°F.	°F.	°F.	°F.	Year	°F.	Year		Inches	Year
January-----	58.0	26.6	42.3	82	1950	-7	1951	0.48	1.50	1958
February----	59.5	28.5	44.0	83	1956 4/	-8	1951	0.46	0.54	1951
March-------	66.9	33.3	50.1	88	1956	9	1952	0.56	0.83	1958
April-------	75.2	42.1	58.7	98	1959	24	1959 4/	1.23	1.69	1954
May---------	84.9	54.0	69.5	103	1953	32	1954	2.76	2.53	1954
June--------	94.1	65.0	79.6	107	1957	45	1955	2.18	1.38	1959
July--------	92.6	66.0	79.3	109	1958	48	1951	3.21	3.85	1960
August------	92.5	65.7	79.1	103	1954	52	1956	1.57	2.03	1951
September---	86.1	56.8	71.5	101	1953	40	1951	1.85	2.61	1959
October-----	76.2	46.2	61.2	94	1954 4/	27	1955	2.63	2.89	1953
November----	64.5	32.0	48.3	87	1952	8	1957	0.33	0.57	1957
December----	57.6	27.8	42.7	81	1958	1	1950	0.38	0.64	1960
Year---	75.7	45.3	60.5	109	1958	-8	1951	17.64	3.85	1960

1/ Length of record: Averages of temperature, 10 years; extremes of temperature and all precipitation, 11 years.

2/ Length of record: 5 years, 1956-1960, inclusive.

Climate[8]

Hockley County has a semiarid, warm, continental climate characteristic of the Southern High Plains. Data on climate in the county are given in table 5.

Rains occur most frequently in thunderstorms, and the monthly and annual amounts vary extremely. The maximum rainfall usually occurs during May, June, and July, when warm, moist air flows northward from the Gulf of Mexico. More than 80 percent of the average annual rainfall occurs during the warmer half of the year, May through October. During May 1941, 14.00 inches of rain fell, whereas records show several monthly periods with no measurable amount of rainfall. Annual extremes range from 9.59 inches in 1956 to 29.88 inches in 1960. The precipitation during exceptionally wet years has little benefit on crops as it falls during heavy thundershowers, and runoff is excessive.

Snow falls occasionally during the winter months, but it is generally light and remains on the ground only a short time. The mean monthly snowfall data are unduly influenced by rare but exceptionally heavy snows, such as 15.4 inches in February of 1956 and 12.4 inches in March of 1958.

Temperatures, like rainfall, are extremely variable, especially during the coldest 6 months of the year. From November through March, frequent surges of cold air from the north bring rapid and pronounced changes. Cold spells are rather short, however, and west and southwest winds cause rapid warming. Strong, fast-moving cold fronts that follow several weeks of mild weather late in spring sometimes have a disastrous effect on vegetation. This possibility of late freezes discourages the growing of fruit trees anywhere on the high plains. Summer days are hot, and humidity is low, but because of the high elevation and dry air, summer nights are relatively cool and have a minimum temperature in the 60's.

Temperature and precipitation records before 1950 are too incomplete to include in table 5. Extremes of temperature reported in this table have been exceeded during the period 1937–1949 as follows: February 1940, maximum 85° F.; March 1948, maximum 89°; June 1939, maximum 109°; September 1948, maximum 102°; November 1942, maximum 94°; March 1948, minimum 3°; April 1938, minimum 22°; September 1938, minimum 35°; October 1949, minimum 25°; November 1938, minimum 4°.

Extremes of precipitation reported in table 5 have been exceeded during the period 1935–1949 as follows: January 1939, maximum 2.12 inches; February 1948, minimum .78 inch; March 1941, maximum 1.33 inches; April 1943, maximum 1.80 inches; May 1937, maximum 3.23 inches; June 1947, 3.28 inches; August 1937, maximum 2.23 inches; September 1942, maximum 3.10 inches; November 1935, maximum 1.19 inches; December 1946, maximum 1.94 inches.

The terrain in Hockley County offers little resistance to the wind. The blowing season is from January to May. The mean windspeeds are rather high. The strongest continuous winds occur during February, March, and April.

[8] By ROBERT B. ORTON, State climatologist, Weather Bureau, U.S. Dept. of Commerce.

AT LEVELLAND, 1950-1960 1/

Precipitation (Continued)					Average number of days when maximum temperature is 2/		Average number of days when minimum temperature is 2/	
Driest year (1956)	Wettest year (1960)	Snow, sleet						
		Average	Most in 1 month		90° or above	32° or below	32° or below	0° or below
Inches	Inches	Inches	Inches	Year	Days	Days	Days	Days
(3/)	0.76	1.1	6.0	1952	0	1	25	0
1.54	1.18	3.0	15.4	1956	0	2	18	(5/)
0.00	0.39	1.6	12.4	1958	0	1	11	0
0.21	0.47	(3/)	(3/)	1957 4/	3	0	2	0
1.86	1.43	0.0	0.0	----	10	0	0	0
2.22	6.00	0.0	0.0	----	22	0	0	0
0.56	11.56	0.0	0.0	----	26	0	0	0
0.58	0.77	0.0	0.0	----	25	0	0	0
0.00	0.53	0.0	0.0	----	12	0	0	0
2.22	4.88	0.0	0.0	----	2	0	1	0
0.00	(3/)	0.8	6.0	1957	0	0	14	0
0.40	1.91	1.9	10.0	1960	0	1	25	0
9.59	29.88	8.4	----	----	100	5	96	(5/)

3/ Trace.

4/ Also on earlier dates, months, or years.

5/ Less than one-half day.

These winds often produce severe duststorms in the region. Prevailing winds vary from south to southwest.

Relative humidity is highest during the early morning hours, and lowest during the warmest part of the afternoon. In summer relative humidity readings at 6:00 a.m. generally average from 76 to 78 percent, whereas readings at 6:00 p.m. are in the range of 37 to 39 percent. The lowest relative humidity is recorded in the spring, following warm southwest winds.

Damaging hailstorms may come any time from spring planting to fall harvest. However, these storms are relatively infrequent and usually cover a small area. Although hailstorms occur mostly late in spring and early in summer, their damage to cotton and grain sorghum may be more costly late in summer and early in fall, when the crops are mature.

The growing season is long enough for cotton. The average number of days between the last occurrence of 32° F. in spring and the first occurrence of 32° in fall is 205 days. The average number of days between the last occurrence of 28° in the spring and the first occurrence of 28° in the fall is 223 days. Figures 24 and 25 show the probabilities of freezing temperatures occurring after specified dates in spring and before specified dates in fall.

Sunshine is abundant the year round. Cloudy weather is infrequent and occurs mostly during the late winter and spring months. The average annual sky cover from sunrise to sunset is about four-tenths. It is about six-tenths in February and five-tenths in April and May.

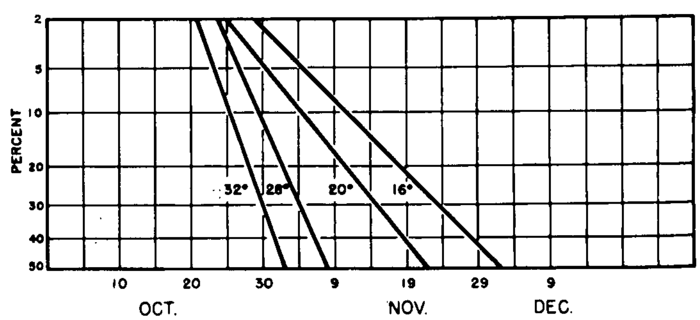

Figure 24.—**Probability that the first freezing temperatures of 32°, 28°, 20°, and 16° will occur before specified dates in fall.**

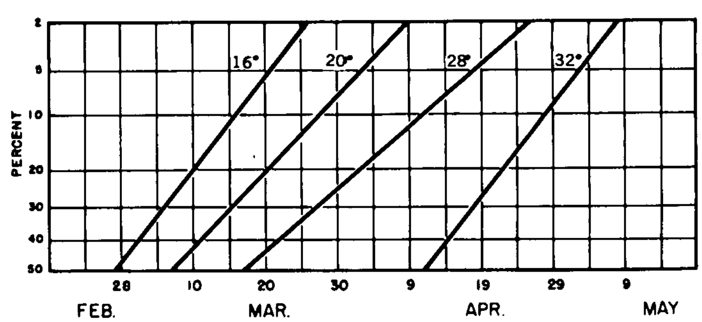

Figure 25.—**Probability that the last freezing temperatures of 16°, 20°, 28°, and 32° will occur after specified dates in spring.**

As would be expected, evaporation is high in this semiarid region compared with the humid region of east Texas. The average annual evaporation from weather bureau pans is about 102 inches. Of this amount, about 66 percent evaporates during the growing season which is from May through October. Average annual lake evaporation is approximately 70 inches.

Geology

The outstanding geologic event in the history of Hockley County was the deposition of the Ogallala formation. This formation is the main source of irrigation water in the county. It was formed from materials deposited more than a million years ago during the early Pliocene epoch. To understand how this underground formation developed, it is necessary to review the geologic history of the area.

About 200 million years ago, shortly before the uplift of the Appalachian Mountains, a shallow sea covered the area that is now western Texas. Marine sediments that were deposited during this period formed the Permian Red Beds. While the Appalachian Mountains were being formed, the High Plains rose above the level of the sea. Streams that flowed over the exposed Permian rocks eroded fine-textured materials and redeposited them along the flood plains. These materials formed the Triassic Red Beds, or the impervious stratum that underlies the Ogallala formation.

During the Cretaceous period, a shallow arm of the sea again partly covered the High Plains. Sand, clay, and limestone were deposited over most of the area.

The formation of the Rocky Mountains was the next significant development. Swift streams from the mountains cut valleys and canyons through the Cretaceous rocks formed from the deposits of the Cretaceous period and into the underlying Triassic Red Beds. Most of the Cretaceous material that had been deposited on the High Plains was washed away. In Hockley County the Cretaceous formation is spotted, and outcrops occur locally along the western shores of Yellow Lake (fig. 4, p. 4).

When the Rocky Mountains reached enough height, they began to erode. Coarse gravelly material was carried great distances by the swift streams. As the mountains were eroded, the streams became less swift and began to deposit gravel, sand, and silt near their sources. These deposits formed alluvial fans of gravelly, coarse material along the foot slopes of the mountains. The finer materials were transported and spread farther to the east. The Ogallala formation developed from these deposits of outwash more than a million years ago. This outwash was deposited just before the beginning of the ice age. The glaciers did not move as far south as Texas, but during the ice age a much moister climate prevailed in this area. Because of an increase in precipitation, streams formed and flowed across the Ogallala formation. The draws of Hockley County are probably the remains of these streams.

The source of the underground water in Hockley County is not an underground river or lake, but the saturated beds of sand and gravel in the lower part of the Ogallala formation. The Triassic Red Beds underneath the Ogallala formation are nearly impervious, so it is not likely that water could be obtained from any of the lower strata. During the development of the Ogallala, a period of nearly a million years, water from the Rocky Mountains was stored in the water-bearing stratum of the formation. When the Ogallala formation was cut off from the mountains, its source of water was blocked. At present, rain or snow that falls on the High Plains probably is the only source of water to replenish the underground supply.

The water table slopes gently to the southeast, and the water moves very slowly. The natural rate of flow is probably not more than 1 or 2 feet a day. Before wells were drilled for irrigation, the water was discharged mainly by springs along the caprock at about the same rate it was replenished. At present, water is pumped for irrigation faster than it is restored.

The amount of water available varies considerably in places because of variations in the thickness of the water-bearing stratum and the depth to the Red Beds. The Red Beds are undulating or uneven, and in places they rise nearly to the static water table or above it. Probably for this reason, certain areas of Hockley County have no irrigation water.

The materials from which the soils of the county developed were probably deposited and reworked during the Pleistocene epoch. Wind did most of this reworking during the Illinoian age.[9] This age was fairly dry, and the wind shifted and sorted the surface materials. During this age Hockley County was probably a prairie with a scant supply of water. As the glaciers moved southward into the United States, the climate became much wetter. When the glaciers retreated, the climate became more arid, and the soils and vegetation developed as they are now.

History

Hockley County was formed from Bexar County in 1876, but it was not organized until 1921. Before 1921, all county functions were performed by Lubbock County. The county was named for George Hockley, commander of artillery at San Jacinto.

This county is a part of the vast plain that the Spaniards called Llano Estacado, meaning *staked plains*, because rock stakes were used as guides for travelers in the very early days.

In 1870, thousands of buffalo roamed the area, and Plains Indians hunted and camped there. Buffalo hunters arrived about 1874, and the early ranchers came soon afterward.

In 1882, Texas gave 3 million acres of land to the Capitol Land Syndicate in payment for building the State capitol. Part of this land was in Hockley County and was called the XIT Ranch. It began operations in the county in 1890. The Spade and Slaughter ranches began operations soon after.

Agriculture

The county remained essentially a ranching county until 1925 when the railroad reached Levelland and farmers began buying tracts from the ranchers.

Farming increased rapidly along with the steady growth of population and general economy. The first irrigation

[9] See footnote 5, p. 50.

TABLE 6.--ACREAGE OF PRINCIPAL CROPS IN STATED YEARS

Crop	1930	1940	1954	1959
	Acres	Acres	Acres	Acres
Cotton----------	95,145	106,209	179,925	176,628
Grain sorghum---	26,923	89,655	182,501	219,358
Forage sorghum--	40,546	60,263	1,121	5,395

wells were dug in 1938, but the greatest increase in irrigation farming has been since 1946. Cotton and grain sorghum have been the main crops for years.

Farmers began to use tractors extensively in the 1930's. Consequently, the size of the average farm increased from 257 acres in 1930 to 450 acres in 1960. Also, the number of horses and mules decreased from 6,753 in 1930 to 363 in 1959.

The largest acreage is in grain sorghum, but cotton is the main cash crop. Some wheat is also grown. Table 6 shows, for stated years, the acreage of principal crops in the county, and table 7, the number of livestock on farms, according to the U.S. Census of Agriculture.

Peaches, cherries, apricots, apples, and strawberries are grown on farms for home use and some onions, carrots, okra, tomatoes, peas, beans, and corn. Onions are the only vegetable grown commercially, but only a few hundred acres are harvested each year.

TABLE 7.--NUMBER OF LIVESTOCK ON FARMS IN STATED YEARS

Livestock	1930	1940	1954	1959
Cattle------------	21,432	15,546	8,549	9,022
Swine-------------	3,513	7,191	3,479	6,018
Horses and mules--	6,753	2,251	279	363

Natural Resources, Public Facilities, and Industry

Soil and oil are the greatest natural resources of Hockley County. Good grass for grazing, a product of good soil, attracted the first cattle ranchers. The fertile soil was easily adapted to farming, and farmers produced good yields of cotton, grain sorghum, and other crops.

The first oil well was drilled in 1938, and the county now has 2,500 producing wells. Oil has contributed greatly to the county's economy.

Irrigation water is also an important natural resource. Since the Second World War, irrigation has steadily increased, and now about 240,000 acres of the county are irrigated.

High schools are at Levelland, Sundown, Anton, Smyer, Ropesville, Whitharral, Pettit, and Pep. South Plains Junior College is also at Levelland. The county has churches of most denominations.

All rural sections have electricity, and telephones are quite common. Farms are highly mechanized, but cotton is hoed and harvested by hand.

Most industries in this county are related to agriculture. Throughout the county there are 28 cotton gins, several cotton warehouses, a cotton compress, seven grain storage elevators, a cotton delinting plant, and a meatpacking plant.

The nonagricultural enterprises include oil wells, two plants that convert oil-field gas to usable products, and caliche mines. Most of the caliche, which comes from open pits, is used for building and maintaining local roads.

Hockley County is well served by highways and railroads. A spur of the Santa Fe Railway crosses the center of the county and connects Smyer and Levelland with Lubbock and other points. Another spur of the Santa Fe crosses the southeast corner of the county and serves Ropesville. A main line of the Santa Fe Railway serves Anton in the northeastern part of the county.

State and Federal highways cross the county and provide bus and motortruck service to all parts of the State. More than a hundred miles of hard-surfaced farm roads connect every part of the county with markets.

Glossary

Aggregate, soil. Many fine soil particles held in a single mass or cluster, such as a clod, crumb, block, or prism.

Alkaline soil. Any soil that is alkaline throughout most or all of the root zone; any soil horizon having a pH value greater than 7.0. (See also Reaction.)

Calcareous soil. A soil that contains enough calcium carbonate to effervesce (fizz) when treated with dilute hydrochloric acid.

Caliche. A broad term for secondary calcareous material in layers near the surface. It may be soft and clearly recognized, as in the Cca horizon of the soil; or it may exist in hard, thick beds beneath the solum or be exposed at the surface.

Clay. As a soil separate, mineral soil particles less than 0.002 millimeter (0.000079 inch) in diameter. As a soil textural class, soil material that contains 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt. In engineering, clay is defined as fine-grained soil particles that are smaller than 0.005 millimeter.

Complex, soil. A mapping unit consisting of different kinds of soil that are in areas too small or too intricately mingled to be shown separately on a map of the scale used.

Concave slope. The term applied to land surfaces that are curved like the interior of a hollow sphere. In level areas concave spots may be dished or swalelike.

Concretions. Rounded and hardened concentrations of chemical compounds, such as calcium carbonate or iron oxides, often formed as concentric rings about a central particle, in the form of hard grains, pellets, or nodules of various sizes, shapes, and colors. The composition of some concretions is unlike that of the surrounding soil.

Consistence, soil. The combination of properties of soil material that determine its resistance to crushing and its ability to be molded or changed in shape. Consistence varies with differences in moisture content; thus, a soil aggregate or clod may be hard when dry and plastic when wet. Terms used to describe consistence are:

Friable. When moist, crushes easily under gentle to moderate pressure between thumb and forefinger and coheres when pressed together. Friable soils are easily tilled.

Firm. When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable. Firm soils are likely to be difficult to till.

Hard. When dry, is moderately resistant to pressure; can be broken in the hands without difficulty but is barely breakable between thumb and forefinger.

Indurated. Very strongly cemented; hard and brittle; does not soften under prolonged wetting.

Loose. Noncoherent when moist or dry. Loose soils are generally coarse textured and are easily tilled.

Plastic. When wet, retains an impressed shape but is readily deformed by moderate pressure; wire formable. Plastic soils contain much clay and are difficult to till.

Sticky. When wet, adheres to thumb and forefinger when pressed; usually, very cohesive when dry.

Soft. Weakly coherent and fragile; when dry, breaks to powder or individual grains under slight pressure.

Gravel. As a soil separate, the rounded or angular fragments of rock that are as much as 3 inches in diameter. As a soil textural class, soil material that consists of 15 to 50 percent gravel by volume. In engineering, gravel is a coarse-grained soil of which more than 50 percent is retained on a No. 4 screen.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes and that differs in one or more ways from adjacent horizons in the same profile. Any horizon may consist of two or more subdivisions or subhorizons, and each subhorizon may have subdivisions. The relative positions of the several soil horizons in the soil profile and their designations are—

A horizon. The master horizon consisting of (1) one or more mineral horizons of maximum organic accumulation; or (2) surface or subsurface horizons that are lighter in color than the underlying horizon and have lost clay minerals, iron, and aluminum, with resultant concentration of the more resistant minerals; or (3) horizons belonging to both of these categories.

B horizon. The master horizon of altered material characterized by (1) an accumulation of clay, iron, or aluminum, with accessory organic matter; or (2) blocky or prismatic structure together with other characteristics, such as stronger colors, unlike those of the A horizon or the underlying horizons of nearly unchanged material; or (3) characteristics of both these categories. Commonly, the lower limit of the B horizon corresponds with the lower limit of the solum.

C horizon. A layer of unconsolidated material, relatively little affected by organisms and presumed to be similar in chemical, physical, and mineralogical composition to the material from which at least a part of the solum has developed.

D horizon. Any stratum underlying the C horizon, or the B if no C is present, that is unlike the C horizon or unlike the material from which the solum has been formed.

Hummocky. Topography that is irregular or choppy; has small dunes or mounds that are 3 to 10 feet high and side slopes of 3 to 8 percent.

Outwash material. A mantle of soil material, a few feet to 60 feet thick or more, washed from the High Plains and Rocky Mountains by streams of melt water and deposited on the Permian Red Beds during glacial times.

Parent material. The horizon of weathered rock or partly weathered soil material from which the soil develops.

Permeability, soil. The quality of a soil horizon that enables water or air to move through it. Terms used to describe permeability are: *very slow, slow, moderately slow, moderate, moderately rapid, rapid,* and *very rapid.*

Phase, soil. A subdivision of a soil type based on variations within the type not great enough to justify establishing a new type but significant to the use and management of the soil. A soil type, for example, may be divided into phases because of differences in slope, stoniness, thickness or some other characteristic that affects management.

Playa. A flat-bottomed, undrained basin or lakebed that contains water for varying periods following rains. Many playas are dry for long periods and are farmed.

Plowpan. A compacted layer formed in the soil just below plow depth. Packing by farm machinery forms this layer.

Poorly graded soil (engineering). A soil material consisting mainly of soil particles that are fairly uniform in size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Reaction, soil. The degree of acidity or alkalinity of a soil expressed in pH values or in words as follows.

	pH		*pH*
Extremely acid	Below 4.5	Neutral	6.6-7.3
Very strongly acid	4.5-5.0	Mildly alkaline	7.4-7.8
Strongly acid	5.1-5.5	Moderately alkaline	7.9-8.4
Medium acid	5.6-6.0	Strongly alkaline	8.5-9.0
Slightly acid	6.1-6.5	Very strongly alkaline	9.1 and higher

Sand. As a soil separate, individual rock or mineral fragments that have diameters ranging from 0.05 millimeter (0.002 inch) to 2.0 millimeters (0.079 inch). Sand grains consist chiefly of quartz but they may be of any mineral composition. As a soil textural class, any soil that contains 85 percent or more sand and not more than 10 percent clay. In engineering, sand is defined as a coarse-grained soil of which more than 50 percent passes through a No. 4 screen.

Series, soil. A group of soils formed from the same kind of parent material and having genetic horizons that, except for texture of the surface layer, are similar in characteristics and in arrangement in the profile.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper size of clay, 0.002 millimeter, to the lower size of very fine sand, 0.05 millimeter. As a soil textural class, any soil that contains 80 percent or more of silt and less than 12 percent of clay. In engineering, silt is defined as fine-grained soil particles that are larger than 0.005 millimeter in diameter.

Soil. The natural medium for the growth of land plants. A natural body on the surface of the earth, composed of organic and mineral materials.

Soil-improving crop. A legume or a fertilized, nonleguminous crop that is grown for the purpose of improving the soil.

Soil separates. Mineral particles less than 2 millimeters in diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows: *Very coarse sand* (2.0 millimeters to 1.0 millimeter); *coarse sand* (1.0 to 0.5 millimeter); *medium sand* (0.5 to 0.25 millimeter); *fine sand* (0.25 to 0.10 millimeter); *very fine sand* (0.10 to 0.05 millimeter); *silt* (0.05 to 0.002 millimeter); and *clay* (less than 0.002 millimeter).

Structure, soil. The arrangement of individual soil particles into aggregates that have definite shape or pattern. Structure is described in terms of *class, grade,* and *type.*

Class refers to the size of soil aggregates and is expressed as *fine, medium,* or *coarse.*

Grade refers to the strength and distinctness of soil aggregates and is expressed as *weak, moderate,* or *strong.* Soil that is structureless is *massive* if coherent and *single grain* if noncoherent.

Type refers to the shape and arrangement of soil aggregates. The main shapes are *blocky* (angular or subangular), *columnar* (prisms with rounded tops), *platy* (laminated), *prismatic* (vertical axis longer than horizontal axis), and *granular.*

Stubble mulching. Maintaining a protective cover by leaving crop residue as a mulch on the surface of the soil until time to seed the next crop. This protects the soil from hot sun, packing rains, and erosion.

Subsoil. Technically, the B horizon of soils that have a distinct profile. In soils that have a weak profile, the subsoil is the soil below the plow layer (or its equivalent of surface soil). In normal soils the subsoil is the zone of maximum clay accumulation. In young or steeply sloping soils, the subsoil is a layer similar to the plow layer in appearance but generally lighter in color.

Texture, soil. The relative proportions of sand, silt, and clay in the soil. (See sand, silt, and clay.)

Topsoil. Soil material that contains organic matter and is suitable as a surfacing for shoulders or slopes.

Type, soil. A subdivision of a soil series. Soils that are similar in kind, thickness, and arrangement of layers and that have the same texture in the surface layer are classified as one soil type.

Water-holding capacity. The capacity, or ability, of a soil to hold water, often expressed in inches of water per foot of soil depth.

Well-graded soil (engineering). A coarse-grained soil that has a wide range of particle sizes. The density and bearing property of such a soil can be easily increased by compaction.

Wilting coefficient (soil). The wilting point. The moisture, in percentage of dry weight, that remains in the soil when plants wilt so much that they cannot be revived when placed in a dark, humid atmosphere.

GUIDE TO MAPPING UNITS, CAPABILITY UNITS, AND RANGE SITES

[See table 1, page 5 , for acreage and proportionate extent of soils; table 2, page 29, for predicted average acre yields of principal crops; table 3, page 34, and table 4, page 44, for engineering properties of the soils]

Map symbol	Mapping unit	Page	Capability unit: Dryland Symbol	Dryland Page	Irrigated Symbol	Irrigated Page	Range site Name	Range site Page
AfA	Amarillo fine sandy loam, 0 to 1 percent slopes------------------------	6	IIIe-4	19	IIe-4	25	Mixed Land	31
AfB	Amarillo fine sandy loam, 1 to 3 percent slopes------------------------	6	IIIe-4	19	IIIe-5	26	Mixed Land	31
AfC	Amarillo fine sandy loam, 3 to 5 percent slopes------------------------	6	IVe-4	21	IVe-2	28	Mixed Land	31
AlA	Amarillo loam, 0 to 1 percent slopes--	6	IIIce-2	20	IIe-2	25	Deep Hardland	31
AlB	Amarillo loam, 1 to 3 percent slopes--	6	IIIe-2	19	IIIe-3	26	Deep Hardland	31
AmB	Amarillo loamy fine sand, 0 to 3 percent slopes------------------------	6	IVe-7	21	IIIe-8	27	Sandy Land	32
An	Arch fine sandy loam-----------------	7	IVes-1	21	IIIes-1	27	High Lime	32
Ar	Arch clay loam----------------------	7	IVes-1	21	IIIes-1	27	High Lime	32
AvA	Arvana fine sandy loam, 0 to 1 percent slopes----------------------------	7	IIIe-4	19	IIe-4	25	Mixed Land	31
AvB	Arvana fine sandy loam, 1 to 3 percent slopes----------------------------	7	IIIe-4	19	IIIe-5	26	Mixed Land	31
AxA	Arvana fine sandy loam, shallow, 0 to 1 percent slopes-------------------	7	IVe-10	21	IIIe-10	27	Mixed Land	31
AxB	Arvana fine sandy loam, shallow, 1 to 3 percent slopes-------------------	8	IVe-10	21	IIIe-10	27	Mixed Land	31
BlC	Berthoud-Mansker loams, 3 to 5 percent slopes----------------------------	8	IVe-1	20	IVe-2	28	Mixed Plains	31
BnB	Bippus clay loam, 1 to 3 percent slopes----------------------------	8	IIIe-2	19	IIIe-2	26	Deep Hardland	31
Br	Brownfield fine sand, thick surface---	9	VIe-6	22	IVe-5	28	Deep Sand	32
Ch	Church clay loam--------------------	9	IVes-1	21	IIIes-1	27	High Lime	32
DrB	Drake soils, 1 to 3 percent slopes----	9	IVes-1	21	IIIes-1	27	High Lime	32
DrC	Drake soils, 3 to 5 percent slopes----	9	VIe-3	22	IVe-4	28	High Lime	32
DrD	Drake soils, 5 to 20 percent slopes---	9	VIe-3	22	-------	--	High Lime	32
Km	Kimbrough soils---------------------	10	VIIs-1	22	-------	--	Shallow Land	32
MfA	Mansker fine sandy loam, 0 to 1 percent slopes------------------------	10	IVe-10	21	IIIe-10	27	Mixed Plains	31
MfB	Mansker fine sandy loam, 1 to 3 percent slopes------------------------	10	IVe-10	21	IIIe-10	27	Mixed Plains	31
MkA	Mansker loam, 0 to 1 percent slopes---	11	IVe-9	21	IIIe-10	27	Mixed Plains	31
MkB	Mansker loam, 1 to 3 percent slopes---	11	IVe-9	21	IIIe-10	27	Mixed Plains	31
OtA	Olton loam, 0 to 1 percent slopes-----	11	IIIce-2	20	IIe-1	25	Deep Hardland	31
PfA	Portales fine sandy loam, 0 to 1 percent slopes------------------------	12	IIIe-6	20	IIe-5	26	Mixed Plains	31
PfB	Portales fine sandy loam, 1 to 3 percent slopes-------------------------	12	IIIe-6	20	IIIe-6	27	Mixed Plains	31
PmA	Portales loam, 0 to 1 percent slopes--	12	IIIce-3	20	IIe-3	25	Mixed Plains	31
PmB	Portales loam, 1 to 3 percent slopes--	12	IIIe-3	19	IIIe-4	26	Mixed Plains	31
Ps	Potter soils------------------------	13	VIIs-1	22	-------	--	Shallow Land	32
Ra	Randall clay------------------------	13	VIw-1	22	-------	--	Same as surrounding soils.	--
Rf	Randall fine sandy loam--------------	13	IVw-1	21	-------	--	Same as surrounding soils.	--
Sl	Stegall-Lea loams, shallow-----------	14	IVe-9	21	IIIe-10	27	Deep Hardland	31
Sp	Spur and Bippus soils----------------	13	IIe-1	19	IIe-2	25	Bottom Land and Deep Hardland.	31
Tv	Tivoli fine sand---------------------	14	VIIe-1	22	-------	--	Deep Sand	32
ZfA	Zita fine sandy loam, 0 to 1 percent slopes----------------------------	15	IIIe-4	19	IIe-4	25	Mixed Land	31
ZmA	Zita loam, 0 to 1 percent slopes------	15	IIIce-2	20	IIe-2	25	Deep Hardland	31

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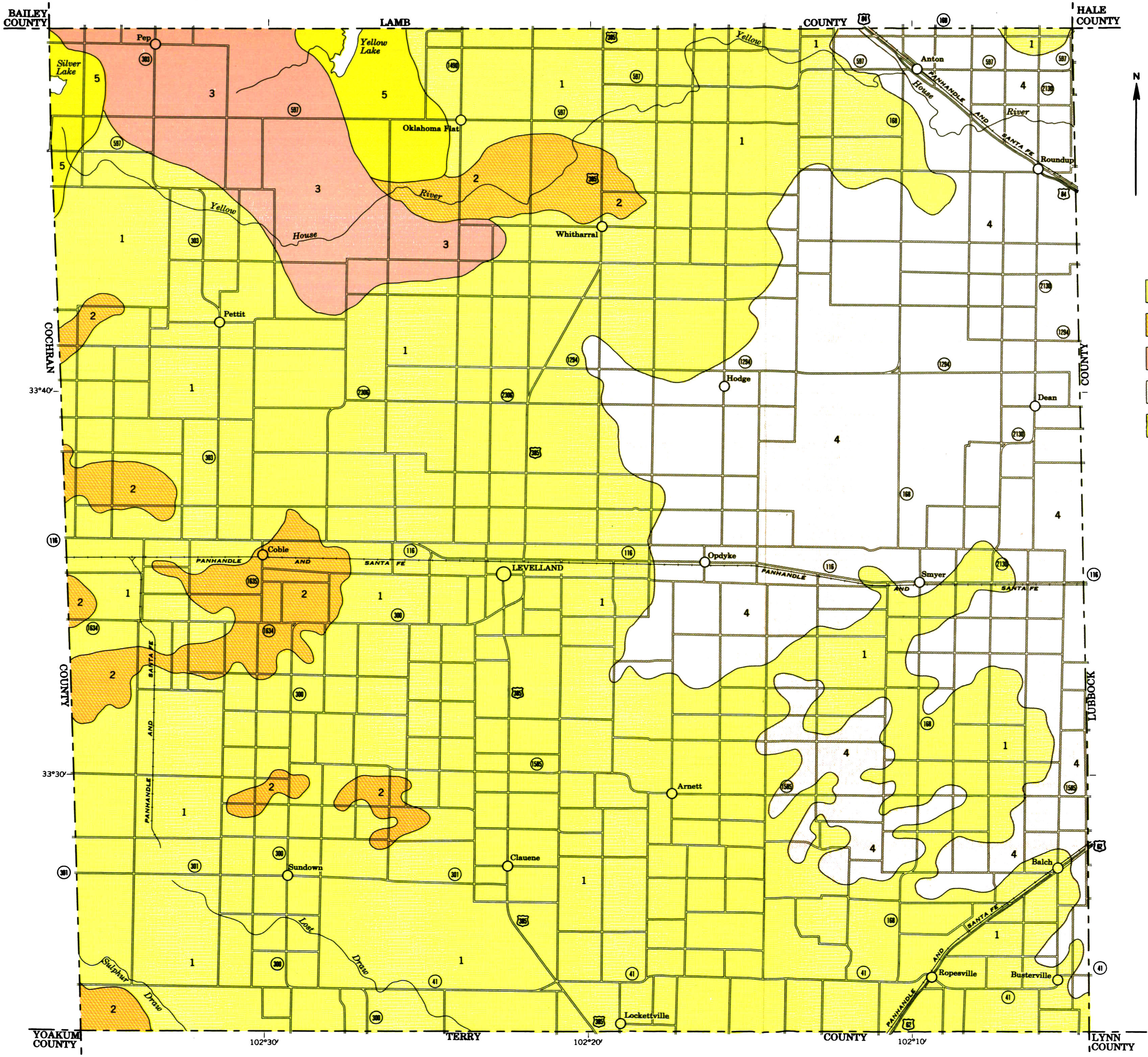
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
TEXAS AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP

HOCKLEY COUNTY, TEXAS



SOIL ASSOCIATIONS

1 Amarillo fine sandy loam association: Deep, nearly level to gently sloping sandy loams

2 Amarillo loamy fine sand association: Deep, nearly level to gently sloping sandy soils

3 Amarillo-Arvana fine sandy loams association: Deep and shallow, nearly level to gently sloping fine sandy loams

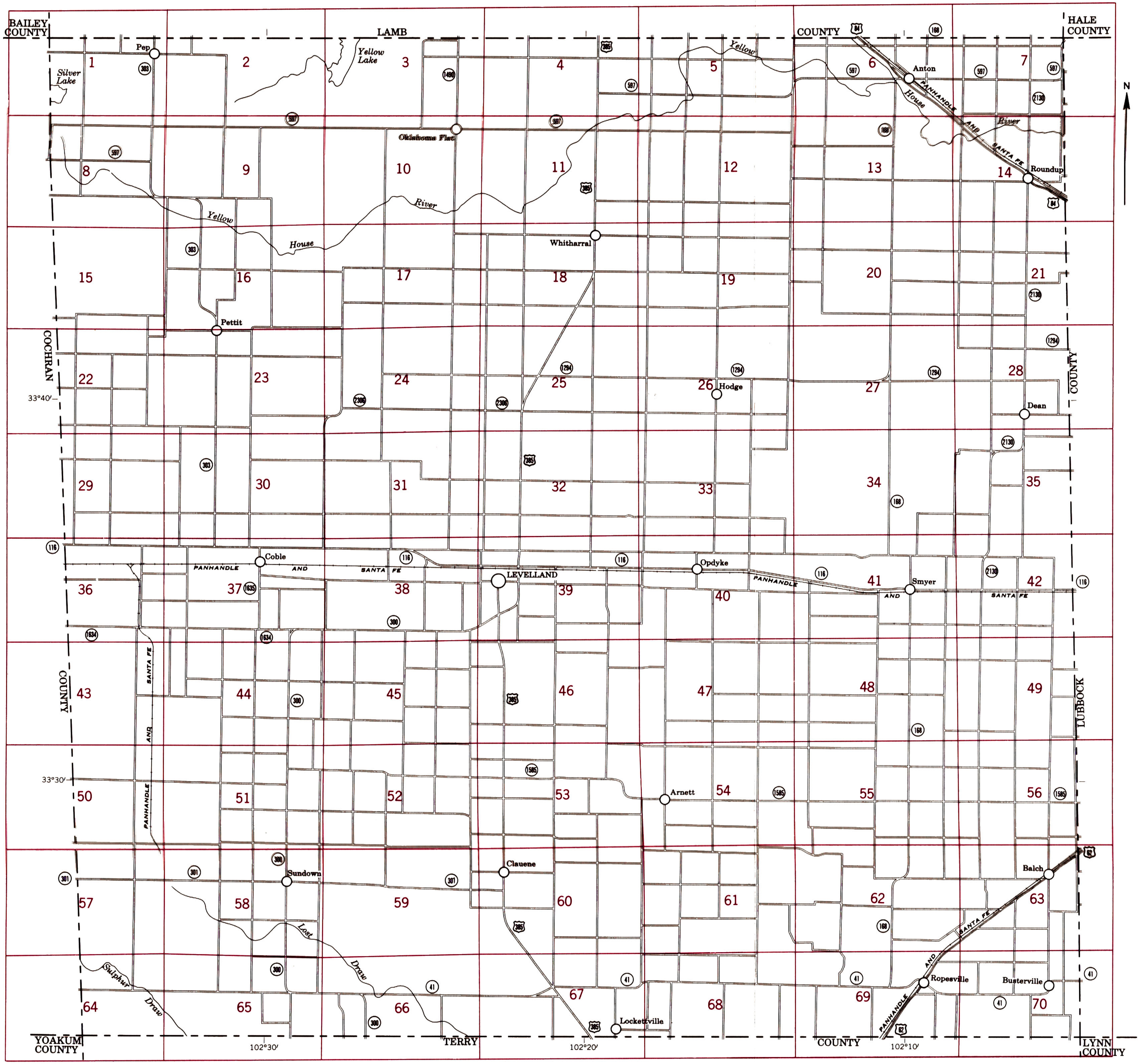
4 Amarillo-Olton loams association: Deep, mainly nearly level hardlands

5 Portales-Arch association: Nearly level to gently sloping limy soils

May 1964

Scale 1:190080

1 0 1 2 3 4 Miles



INDEX TO MAP SHEETS

HOCKLEY COUNTY, TEXAS

Scale 1:190 080

1 0 1 2 3 4 Miles

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

HOCKLEY COUNTY, TEXAS

TEXAS AGRICULTURAL EXPERIMENT STATION

CONVENTIONAL SIGNS

WORKS AND STRUCTURES

Highways and roads
- Dual
- Good motor
- Poor motor
- Trail

Highway markers
- National Interstate
- U. S.
- State

Railroads
- Single track
- Multiple track
- Abandoned

Bridges and crossings
- Road
- Trail, foot
- Railroad
- Ferries
- Ford
- Grade
- R. R. over
- R. R. under
- Tunnel

Buildings
- School
- Church
- Station

Mines and Quarries

Mine dump

Caliche pit

Power lines

Pipe lines

Cemeteries

Dams

Levees

Tanks

Cotton gin

Windmills

BOUNDARIES

- National or state
- County
- Reservation
- Land grant
- Land corners

DRAINAGE

Streams
- Perennial
- Intermittent, unclass.

Canals and ditches — CANAL — DITCH

Lakes and ponds
- Perennial
- Intermittent

Wells — flowing

Springs

Marsh

Wet spot

RELIEF

Escarpments
- Bedrock
- Other

Prominent peaks

Depressions — Large — Small
- Crossable with tillage implements
- Not crossable with tillage implements
- Contains water most of the time

SOIL SURVEY DATA

- Soil boundary and symbol — Dx
- Gravel
- Stones
- Rock outcrops
- Chert fragments
- Clay spot
- Sand spot
- Gumbo or scabby spot
- Made land
- Severely eroded spot
- Blowout, wind erosion
- Gullies

SOIL LEGEND

The first capital letter is the initial one of the soil name. A second capital letter, A, B, C, or D, shows the slope. Most symbols without a slope letter are those for nearly level soils, such as Randall clay, but some are for soils that have considerable range in slope, such as Potter soils. (W) following the soil name indicates that signs of erosion, especially of local shifting of soil by wind, are evident in places, but the degree of erosion cannot be estimated reliably.

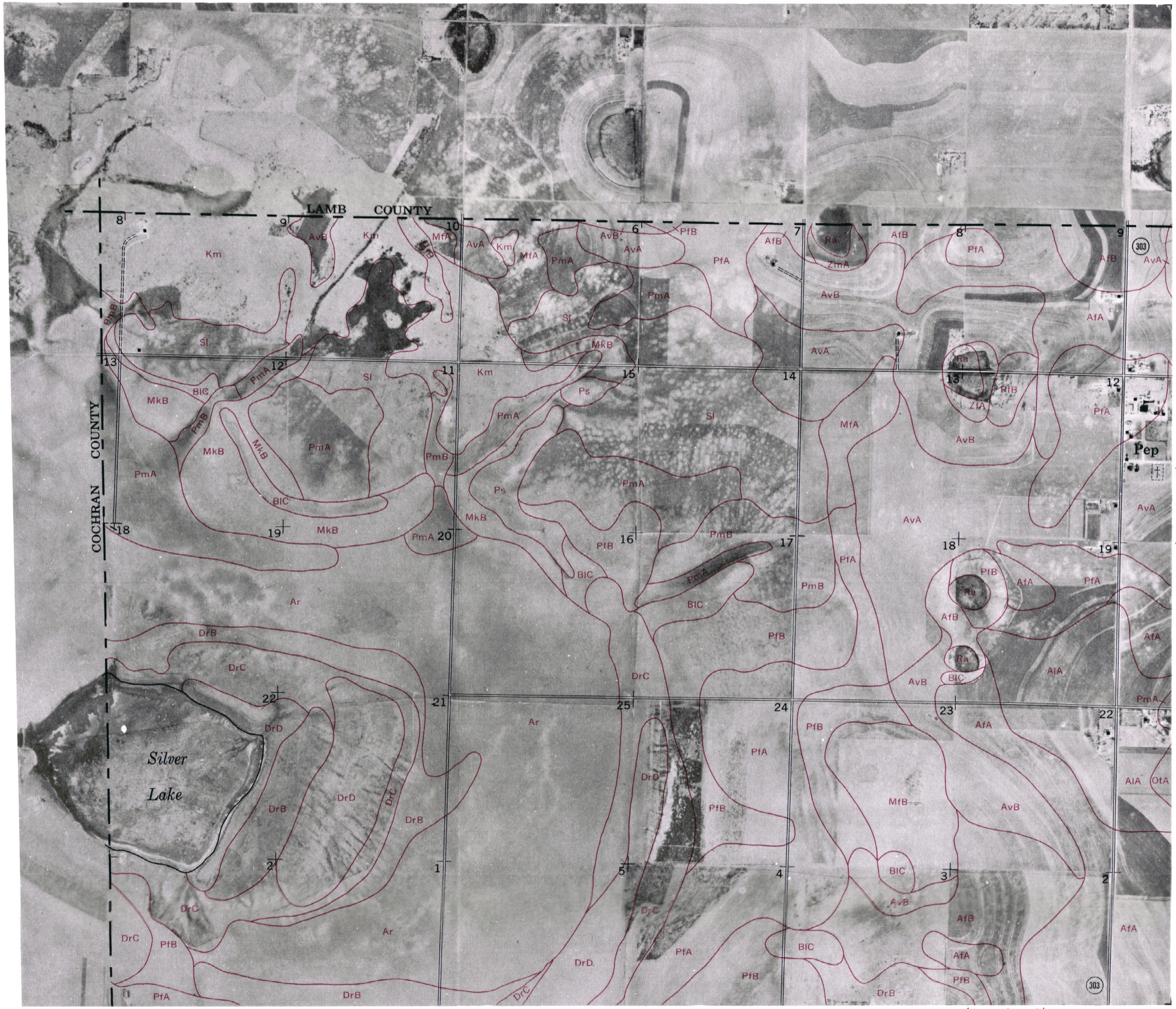
SYMBOL	NAME
AfA	Amarillo fine sandy loam, 0 to 1 percent slopes
AfB	Amarillo fine sandy loam, 1 to 3 percent slopes
AfC	Amarillo fine sandy loam, 3 to 5 percent slopes
AlA	Amarillo loam, 0 to 1 percent slopes
AlB	Amarillo loam, 1 to 3 percent slopes
AmB	Amarillo loamy fine sand, 0 to 3 percent slopes (W)
An	Arch fine sandy loam (W)
Ar	Arch clay loam
AvA	Arvana fine sandy loam, 0 to 1 percent slopes
AvB	Arvana fine sandy loam, 1 to 3 percent slopes
AxA	Arvana fine sandy loam, shallow, 0 to 1 percent slopes
AxB	Arvana fine sandy loam, shallow, 1 to 3 percent slopes
BlC	Berthoud-Mansker loams, 3 to 5 percent slopes (W)
BnB	Bippus clay loam, 1 to 3 percent slopes
Br	Brownfield fine sand, thick surface (W)
Ch	Church clay loam
DrB	Drake soils, 1 to 3 percent slopes (W)
DrC	Drake soils, 3 to 5 percent slopes (W)
DrD	Drake soils, 5 to 20 percent slopes (W)
Km	Kimbrough soils
MfA	Mansker fine sandy loam, 0 to 1 percent slopes
MfB	Mansker fine sandy loam, 1 to 3 percent slopes (W)
MkA	Mansker loam, 0 to 1 percent slopes
MkB	Mansker loam, 1 to 3 percent slopes
OtA	Olton loam, 0 to 1 percent slopes
PfA	Portales fine sandy loam, 0 to 1 percent slopes
PfB	Portales fine sandy loam, 1 to 3 percent slopes
PmA	Portales loam, 0 to 1 percent slopes
PmB	Portales loam, 1 to 3 percent slopes
Ps	Potter soils
Ra	Randall clay
Rf	Randall fine sandy loam
Sl	Stegall-Lea loams, shallow
Sp	Spur and Bippus soils
Tv	Tivoli fine sand (W)
ZfA	Zita fine sandy loam, 0 to 1 percent slopes
ZmA	Zita loam, 0 to 1 percent slopes

Soil map constructed 1964 by Cartographic Division, Soil Conservation Service, USDA, from 1957 aerial photographs. Controlled mosaic based on Texas plane coordinate system, north central zone, Lambert conformal conic projection. 1927 North American datum.

N

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Texas Agricultural Experiment Station.

Land division corners and numbers shown on this map are indefinite.



(Joins sheet 2)

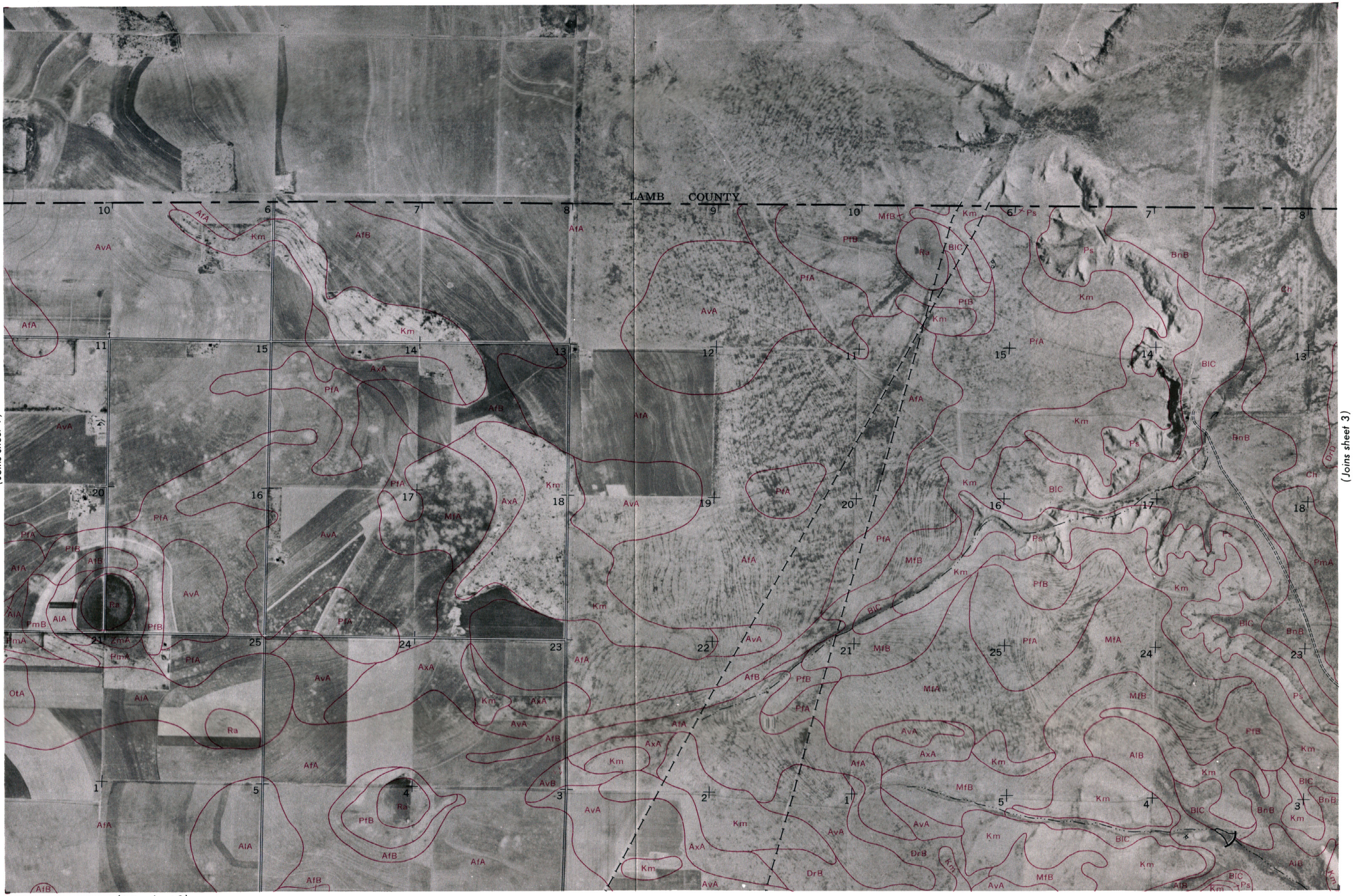
(Joins sheet 8)

0 ½ 1 Mile Scale 1:20000 0 5000 Feet

2

N

(Joins sheet 1)



(Joins sheet 3)

(Joins sheet 9)

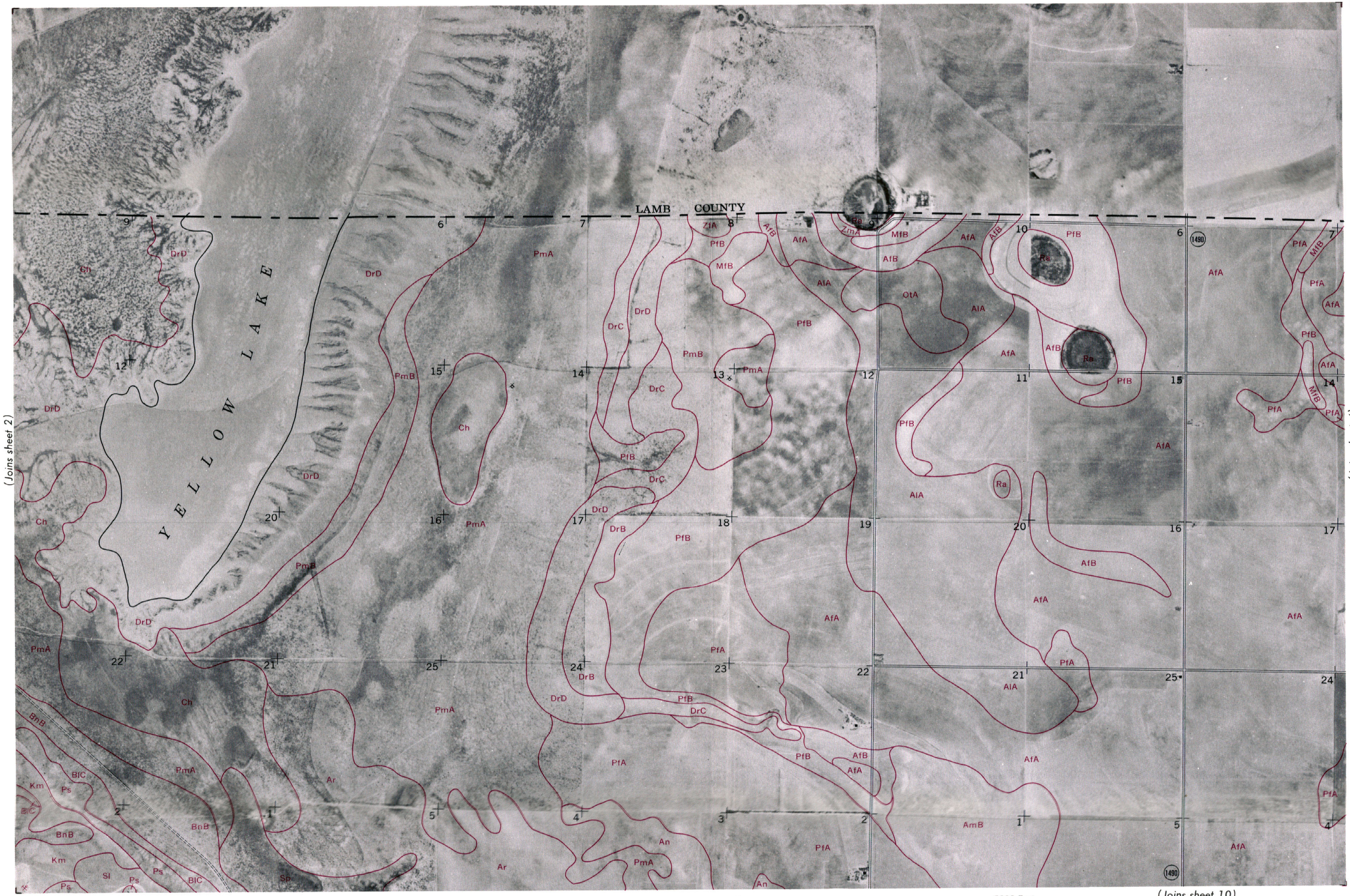
0 ½ 1 Mile

Scale 1:20000

0 5000 Feet

HOCKLEY COUNTY, TEXAS — SHEET NUMBER 3

3



(Joins sheet 2)

(Joins sheet 4)

(Joins sheet 10)

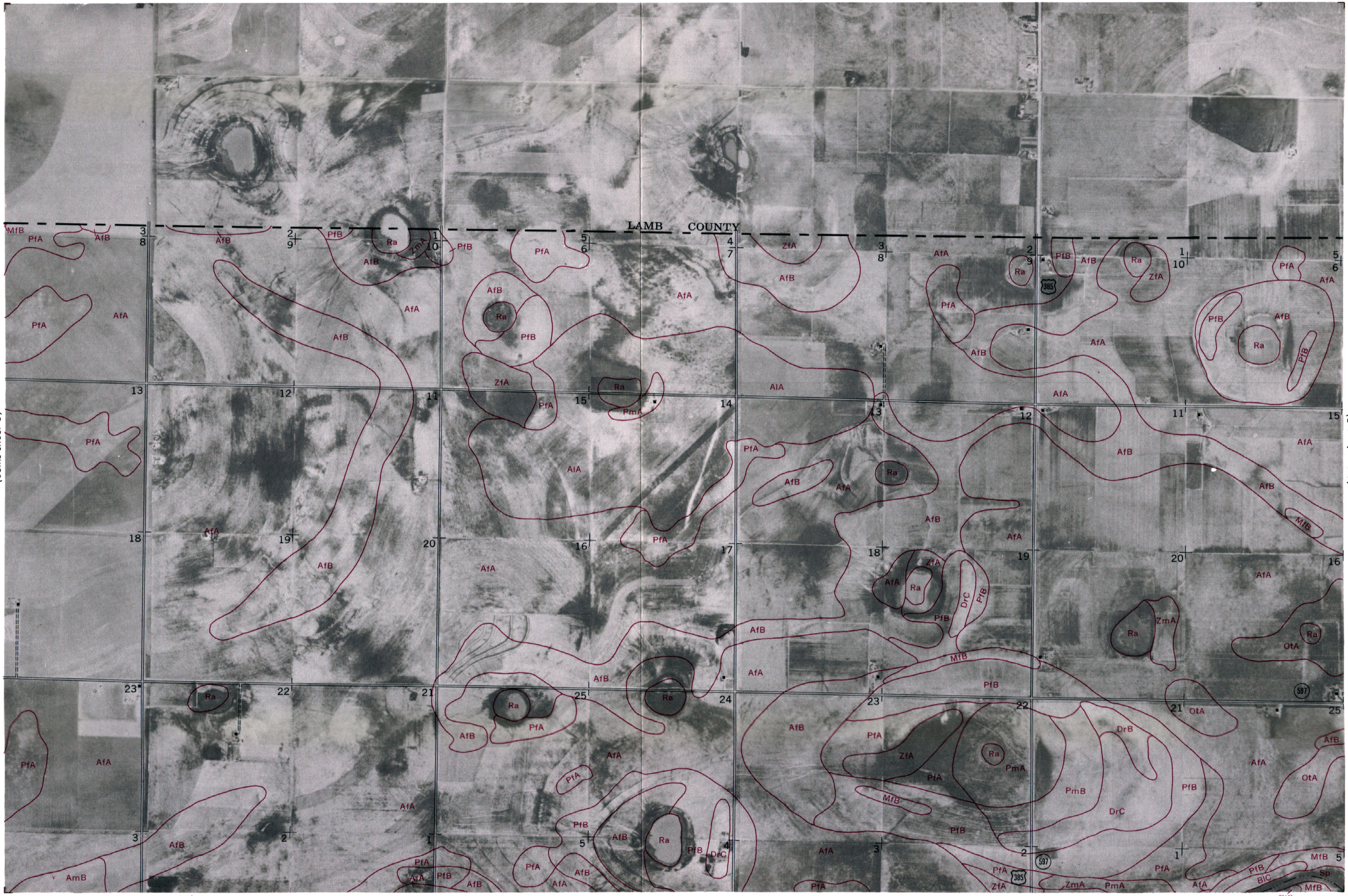
0 ½ 1 Mile Scale 1:20000 0 5000 Feet

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Texas Agricultural Experiment Station.

Land division corners and numbers shown on this map are indefinite.

4

N



(Joins sheet 3)

(Joins sheet 5)

(Joins sheet 11)

0 ½ 1 Mile Scale 1:20000 0 5000 Feet

HOCKLEY COUNTY, TEXAS — SHEET NUMBER 5

5

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Texas Agricultural Experiment Station.
Land division corners and numbers shown on this map are indefinite.

0 ½ 1 Mile Scale 1:20000 0 5000 Feet

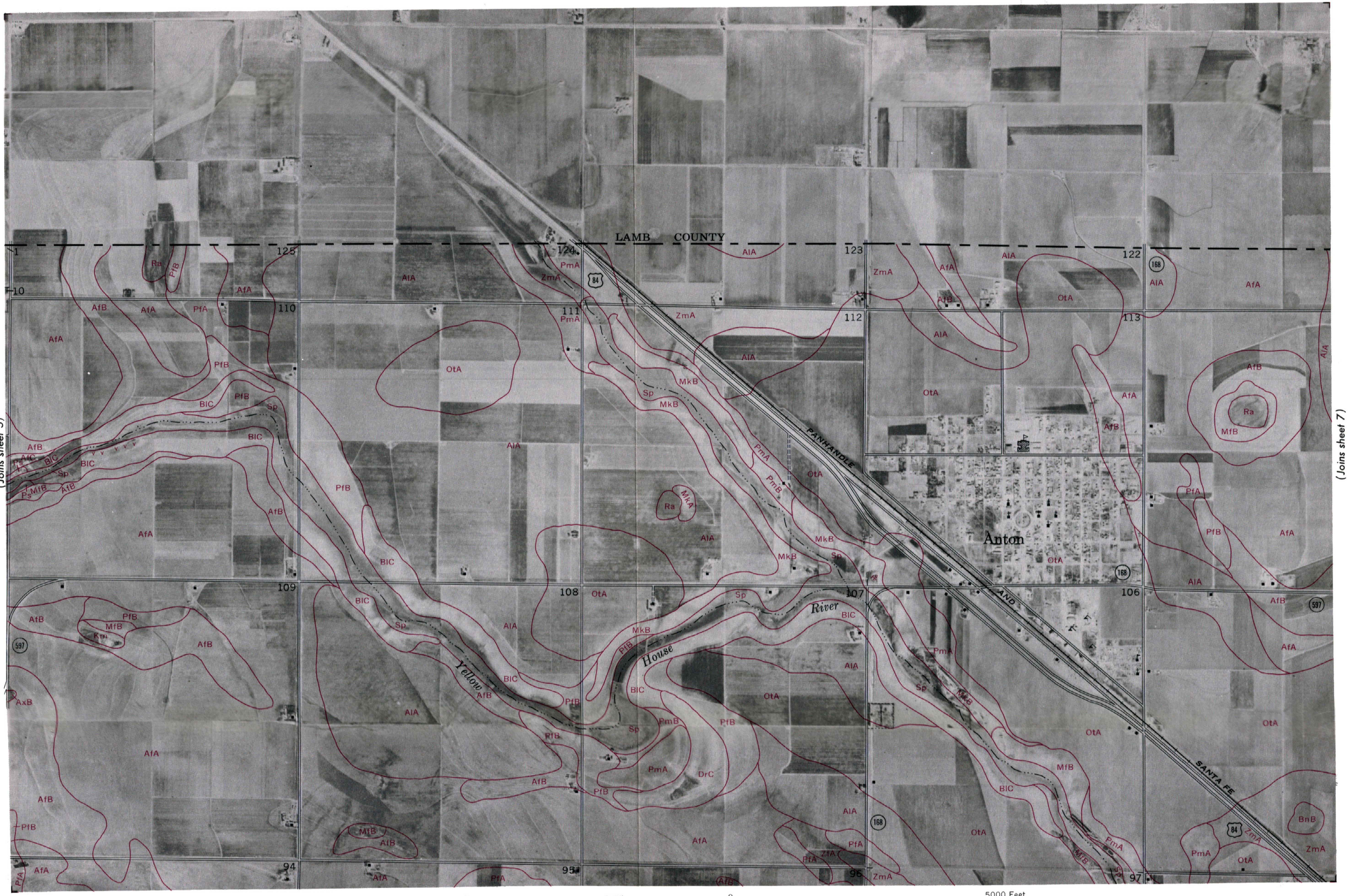
(Joins sheet 12)

6

HOCKLEY COUNTY, TEXAS — SHEET NUMBER 6

N

(Joins sheet 5)



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(Joins sheet 13)

0 ½ 1 Mile

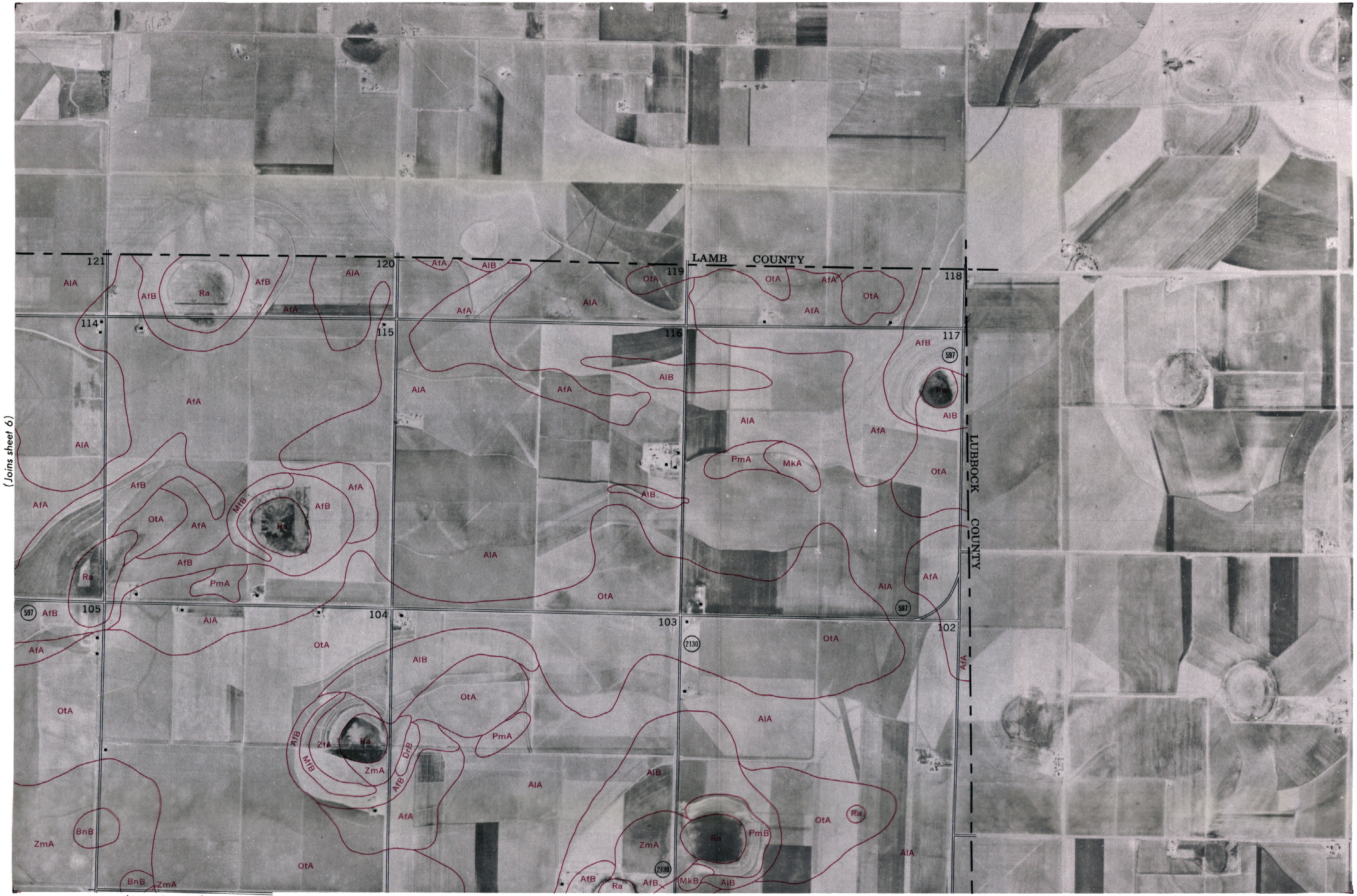
Scale 1:20000

0 5000 Feet

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Texas Agricultural Experiment Station.

Land division corners and numbers shown on this map are indefinite.

(Joins sheet 6)



(Joins sheet 14)

0 ½ 1 Mile Scale 1:20000 0 5000 Feet

HOCKLEY COUNTY, TEXAS — SHEET NUMBER 8

(Joins sheet 1)

N

(Joins sheet 9)

(Joins sheet 15)

0 ½ 1 Mile Scale 1:20000 0 5000 Feet

Scale 1:20000

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Texas Agricultural Experiment Station.

Land division corners and numbers shown on this map are indefinite.

(Joins sheet 3)

N

(Joins sheet 9)

(Joins sheet 11)

(Joins sheet 17)

0 ½ 1 Mile

Scale 1:20000

0 5000 Feet

11

(Joins sheet 4)

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Texas Agricultural Experiment Station.

Land division corners and numbers shown on this map are indefinite.

(Joins sheet 10)

(Joins sheet 12)

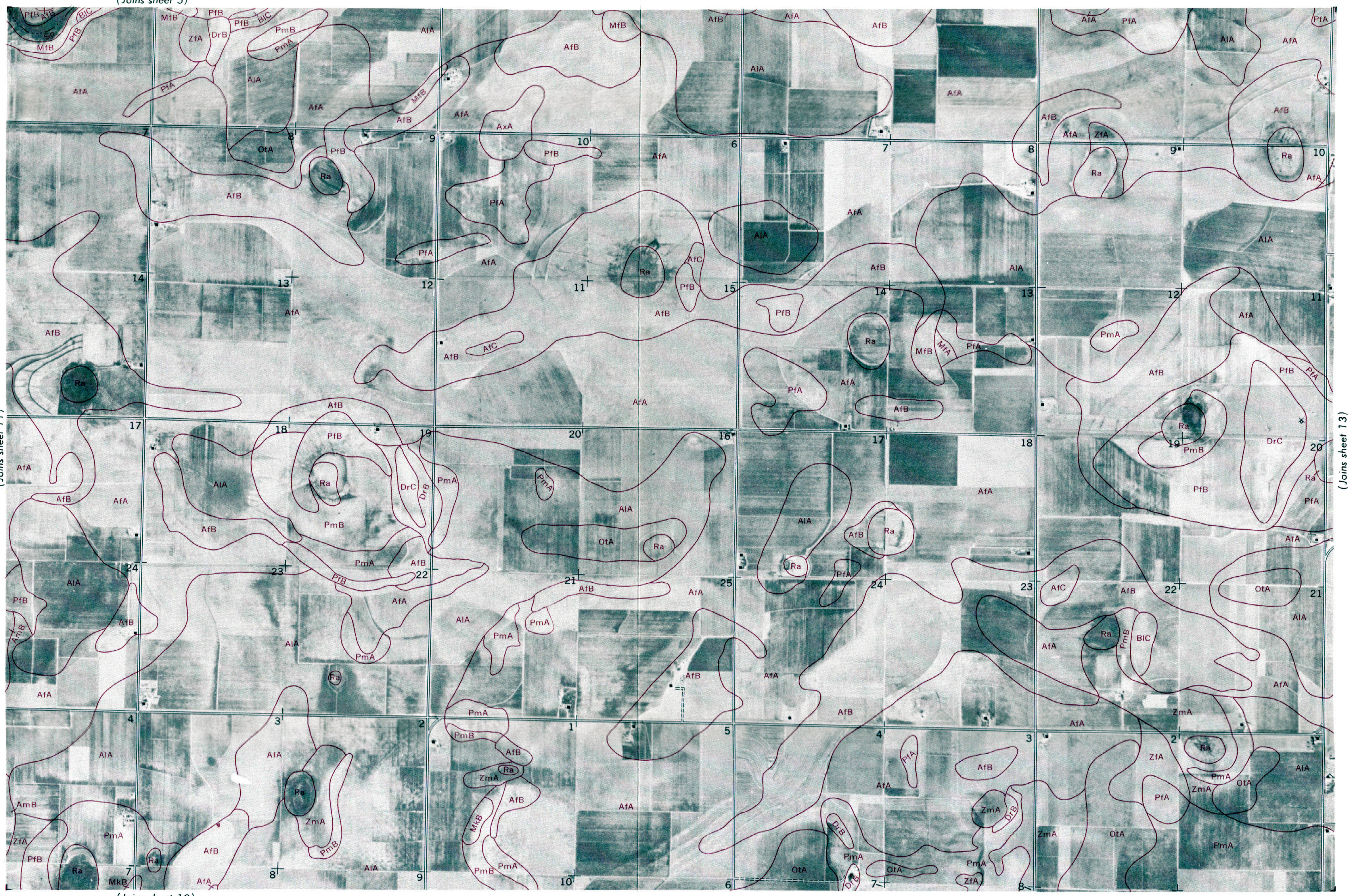
(Joins sheet 18)

0 ½ 1 Mile

Scale 1:20000

0 5000 Feet

12



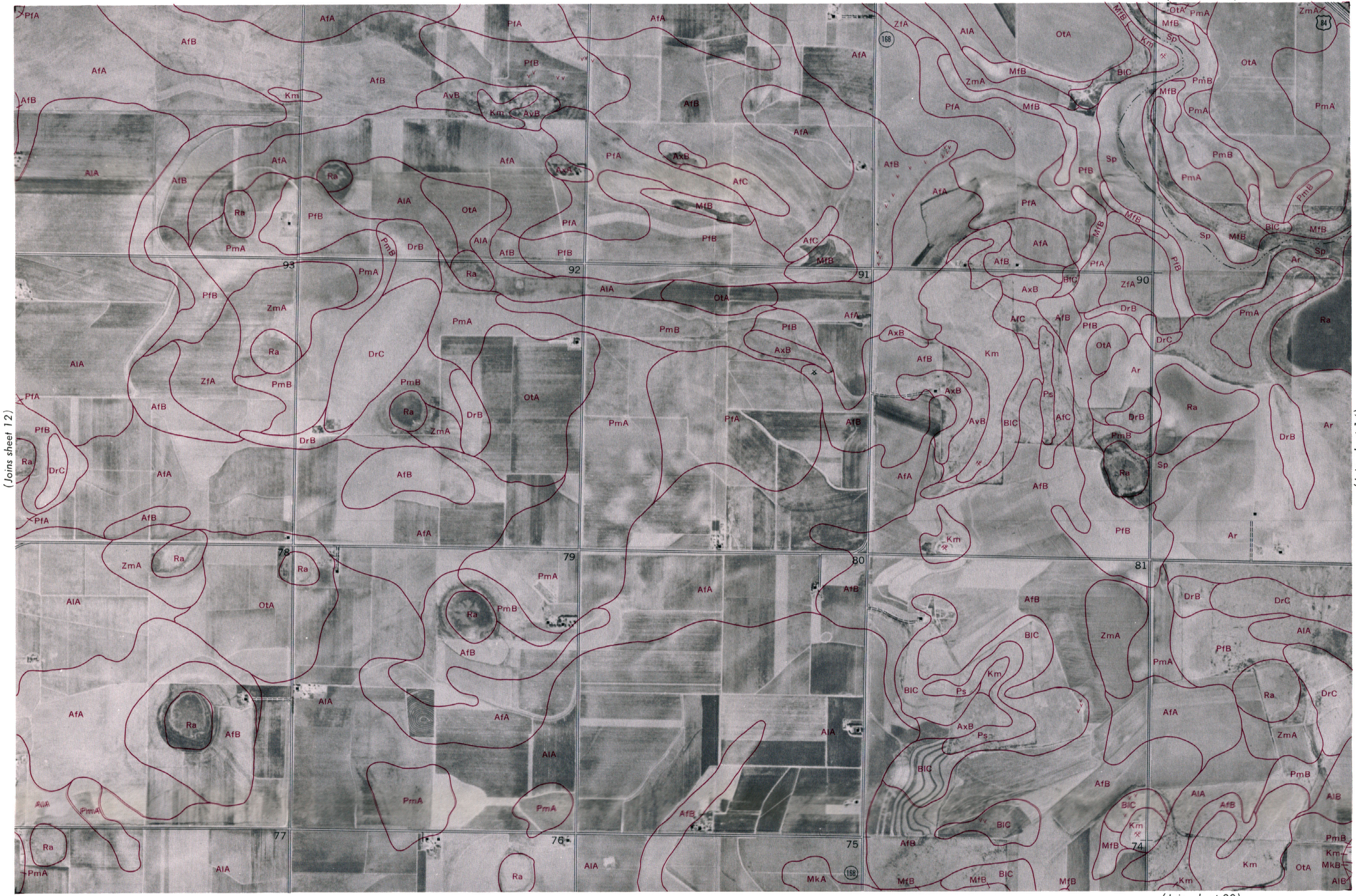
0 ½ 1 Mile

Scale 1:20000

0 5000 Feet

(Joins sheet 6)

(Joins sheet 12)



(Joins sheet 14)

(Joins sheet 20)

N

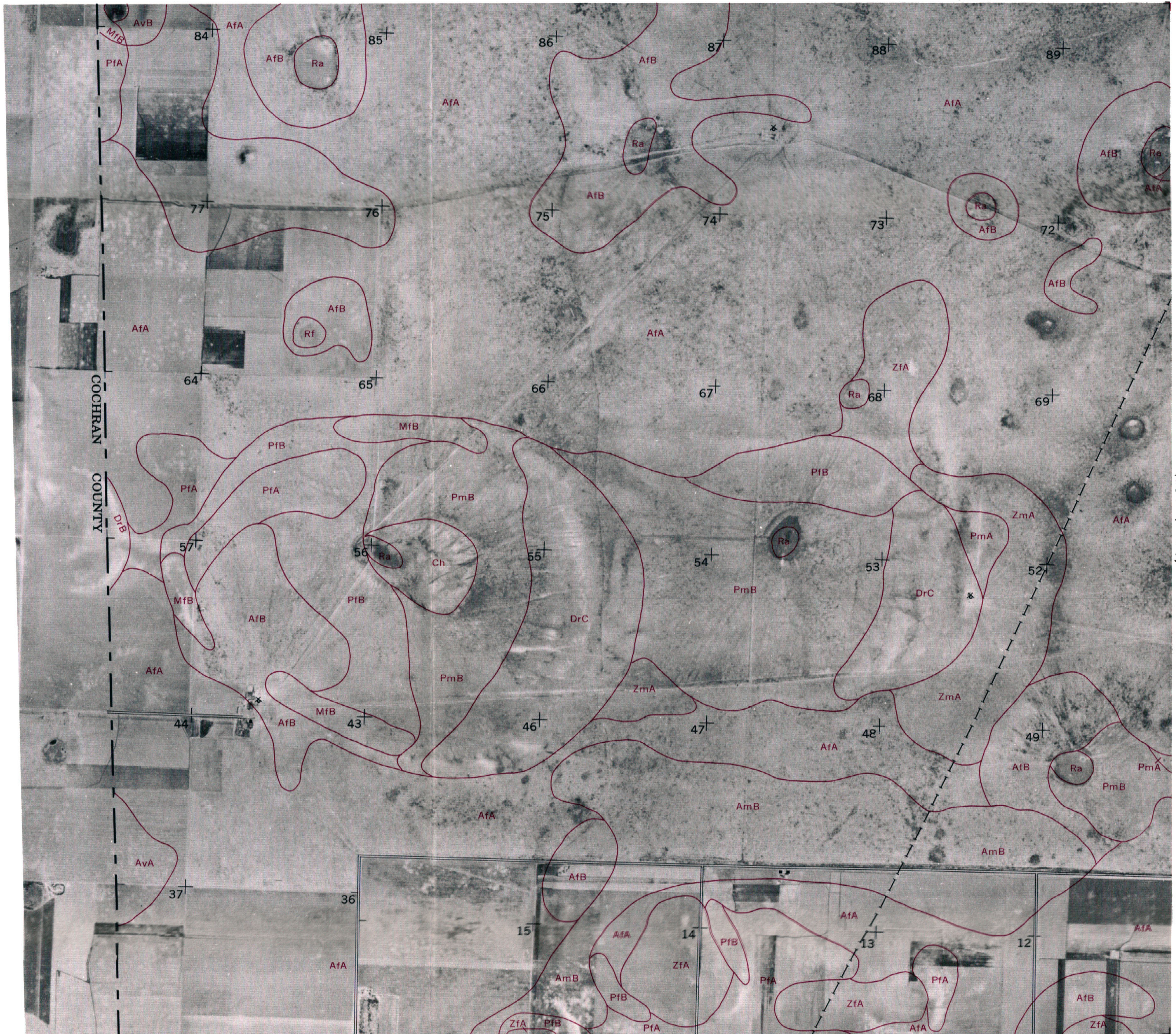
0 ½ 1 Mile Scale 1:20000 0 5000 Feet

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Texas Agricultural Experiment Station.

Land division corners and numbers shown on this map are indefinite.

0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

(Joins sheet 8)



(Joins sheet 22)

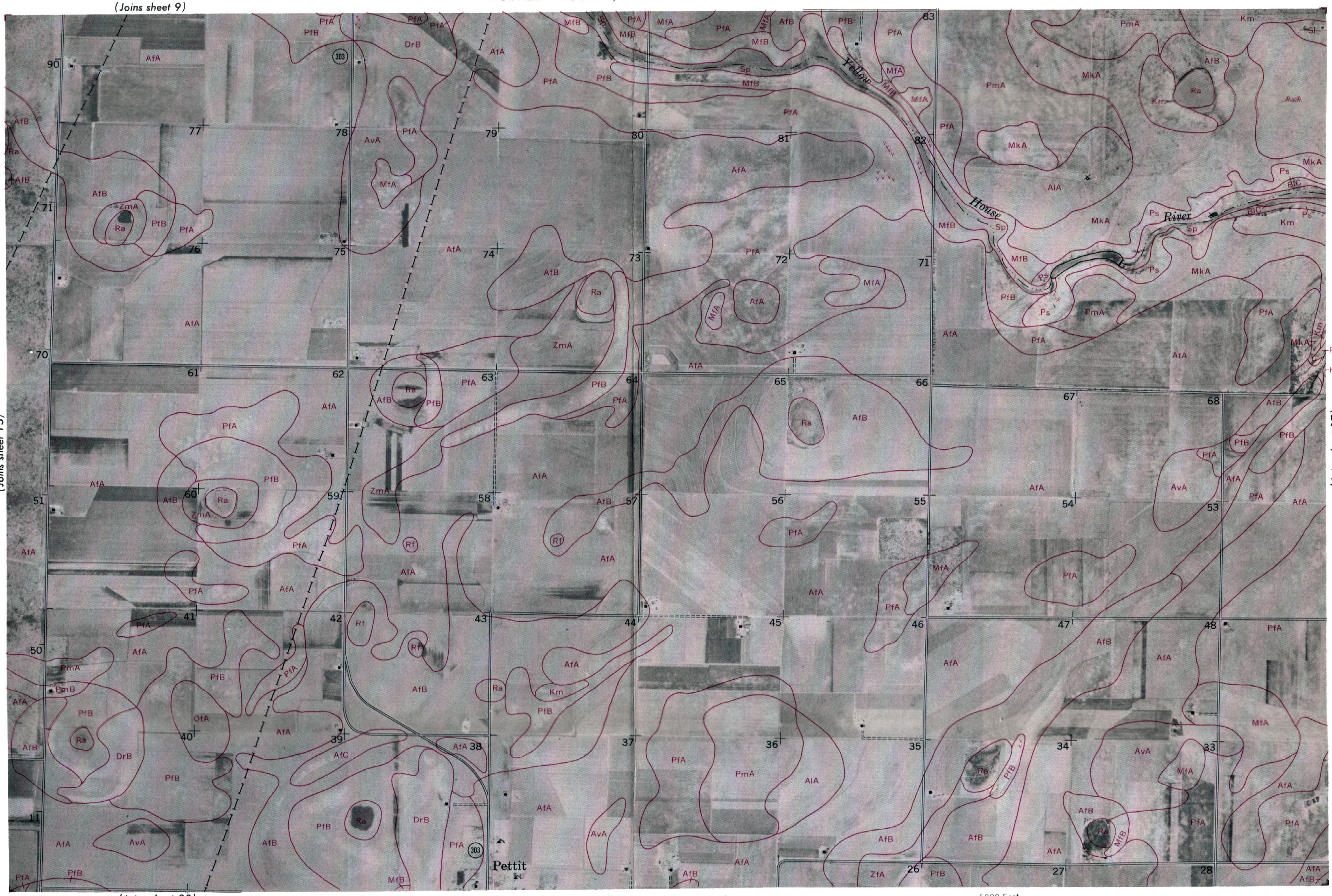
0 ½ 1 Mile Scale 1:20000 0 5000 Feet

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Texas Agricultural Experiment Station.

Land division corners and numbers shown on this map are indefinite.

16

(Joins sheet 9)



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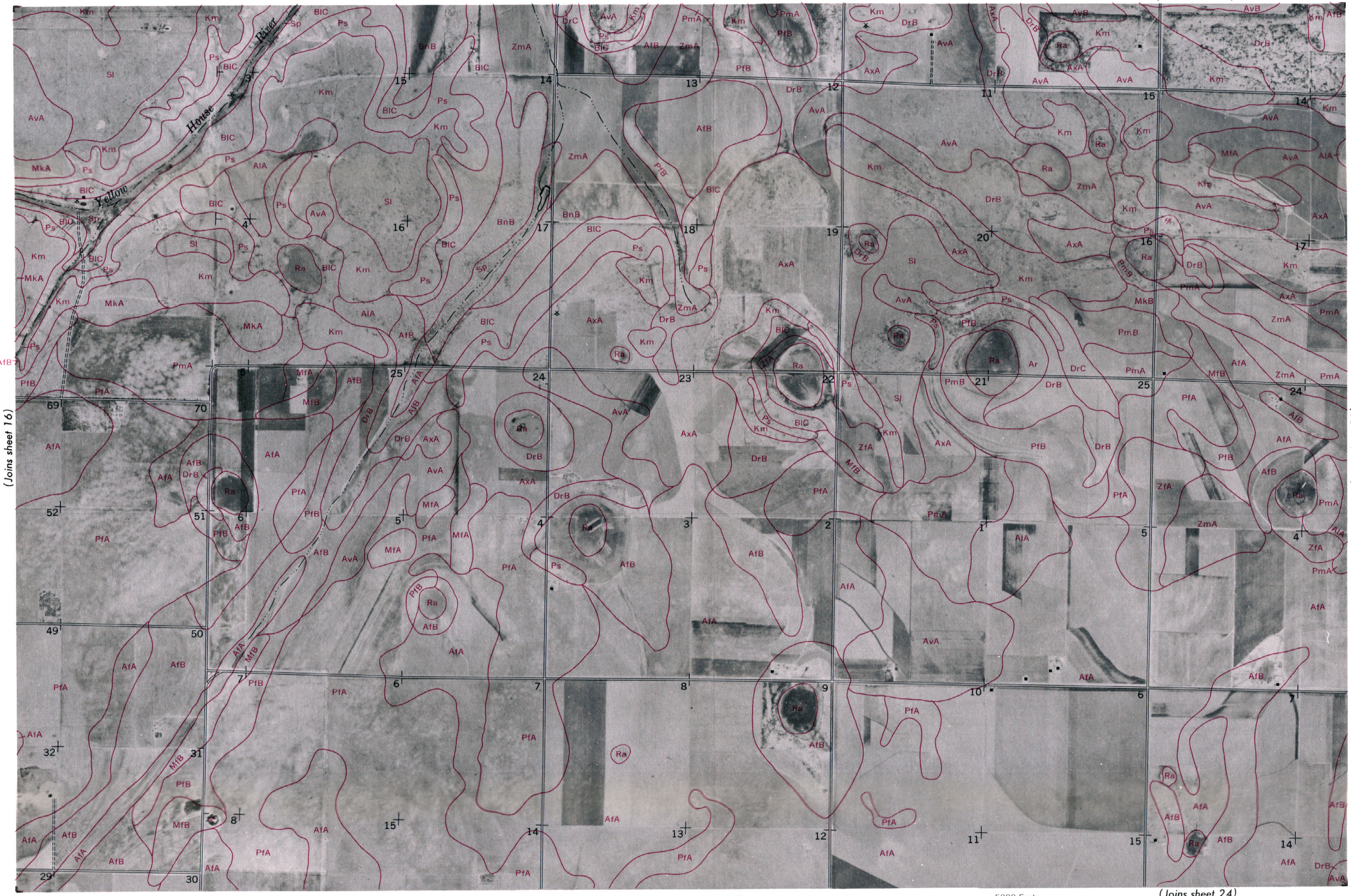
(Joins sheet 17)

(Joins sheet 23)

0 ½ 1 Mile Scale 1:20000 0 5000 Feet



0 ½ 1 Mile Scale 1:20000 0 5000 Feet

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Texas Agricultural Experiment Station.

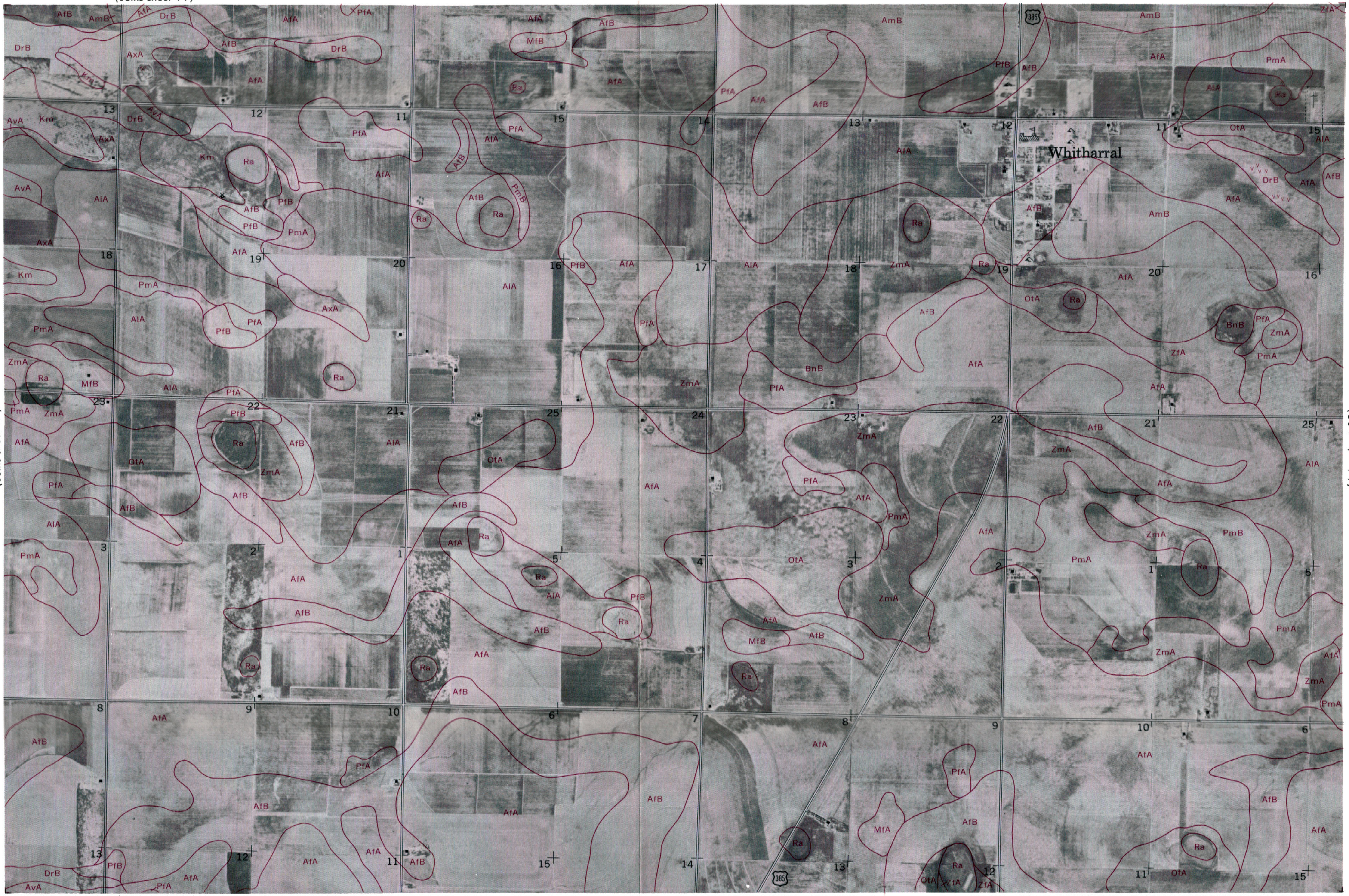
Land division corners and numbers shown on this map are indefinite.

18

(Joins sheet 11)

N

(Joins sheet 17)



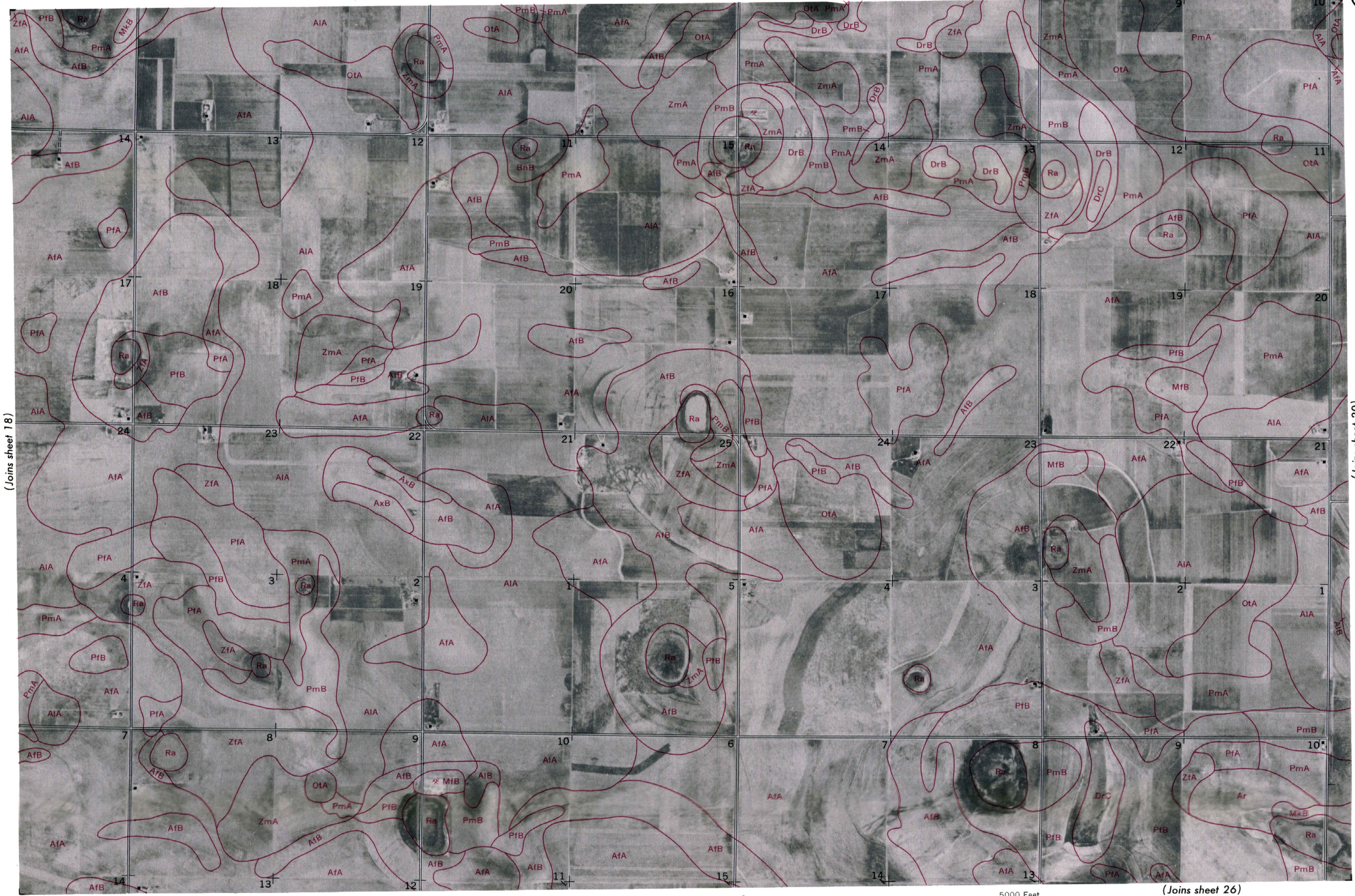
(Joins sheet 19)

(Joins sheet 25)

0 ½ 1 Mile

Scale 1:20000

0 5000 Feet



This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Texas Agricultural Experiment Station.

Land division corners and numbers shown on this map are indefinite.

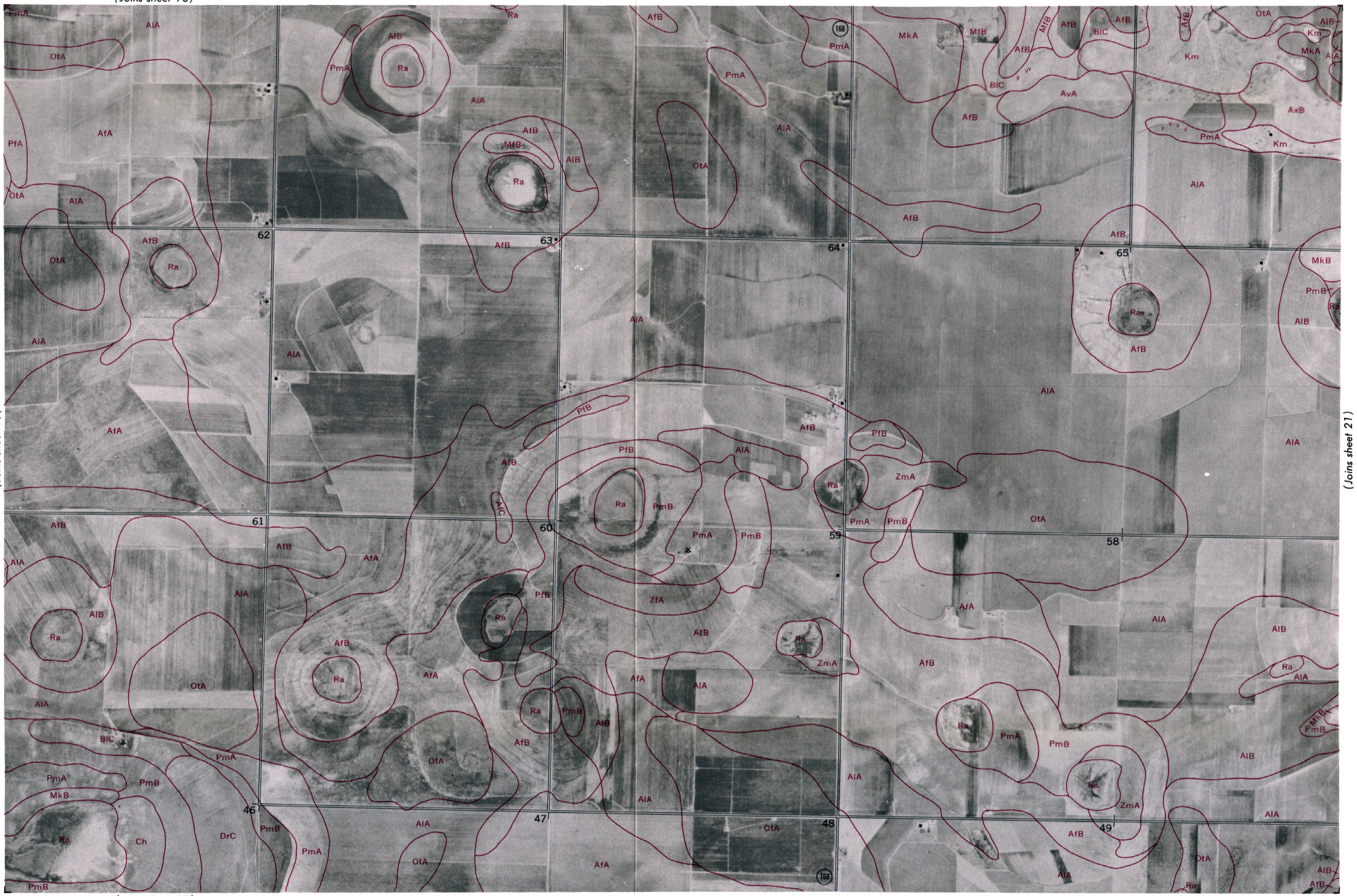
0 ½ 1 Mile Scale 1:20000 0 5000 Feet

HOCKLEY COUNTY, TEXAS — SHEET NUMBER 20

(Joins sheet 13)

N

(Joins sheet 19)



(Joins sheet 21)

(Joins sheet 27)

0 ½ 1 Mile

Scale 1:20000

0 5000 Feet

(Joins sheet 14)

(Joins sheet 20)

N

(Joins sheet 28)

0 ½ 1 Mile

Scale 1:20000

0 5000 Feet

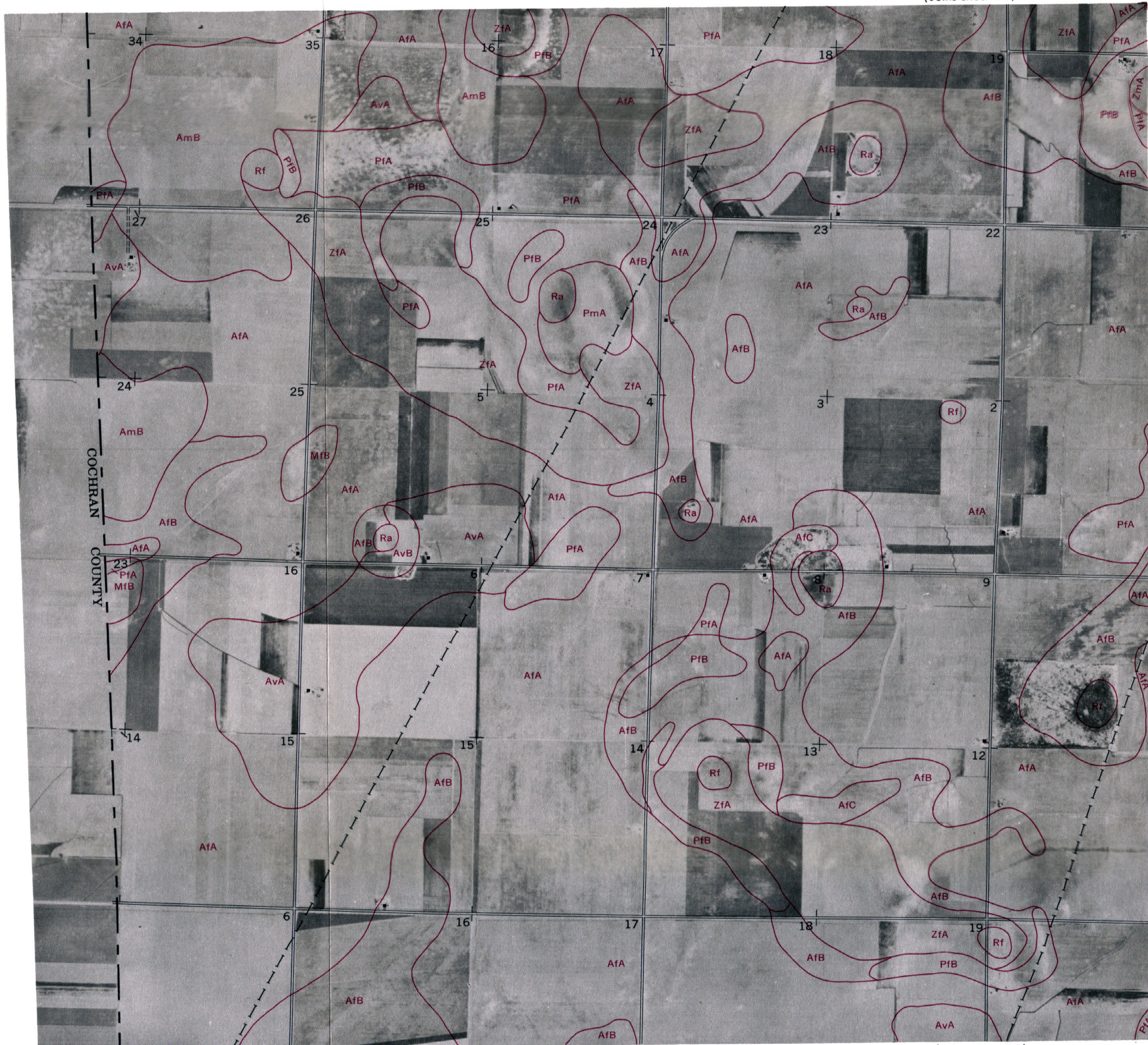
This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Texas Agricultural Experiment Station.

Land division corners and numbers shown on this map are indefinite.

22

N

(Joins sheet 15)



(Joins sheet 23)

(Joins sheet 29)

0 ½ 1 Mile Scale 1:20000 0 5000 Feet

23

(Joins sheet 16)

(Joins sheet 30)

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Texas Agricultural Experiment Station.
Land division corners and numbers shown on this map are indefinite.

0 ½ 1 Mile Scale 1:20000 0 5000 Feet

HOCKLEY COUNTY, TEXAS — SHEET NUMBER 24

24

(Joins sheet 17)

(Joins sheet 23)

(Joins sheet 25)

(Joins sheet 31)

0 ½ 1 Mile

Scale 1:20000

0 5000 Feet

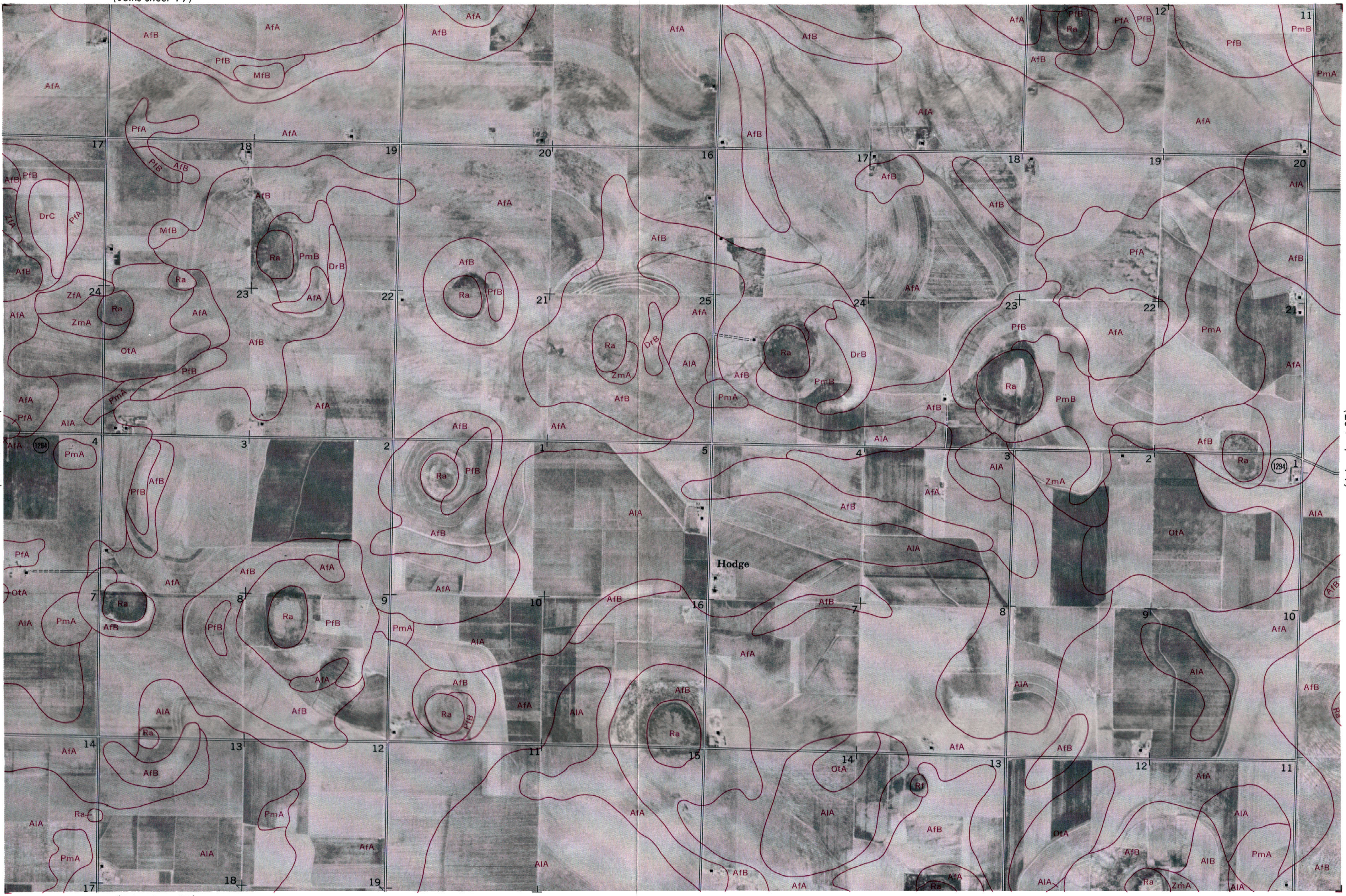
0 ½ 1 Mile Scale 1:20000 0 5000 Feet

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Texas Agricultural Experiment Station.

Land division corners and numbers shown on this map are indefinite.

(26)

(Joins sheet 19)



(Joins sheet 33)

0 ½ 1 Mile Scale 1:20000 0 5000 Feet

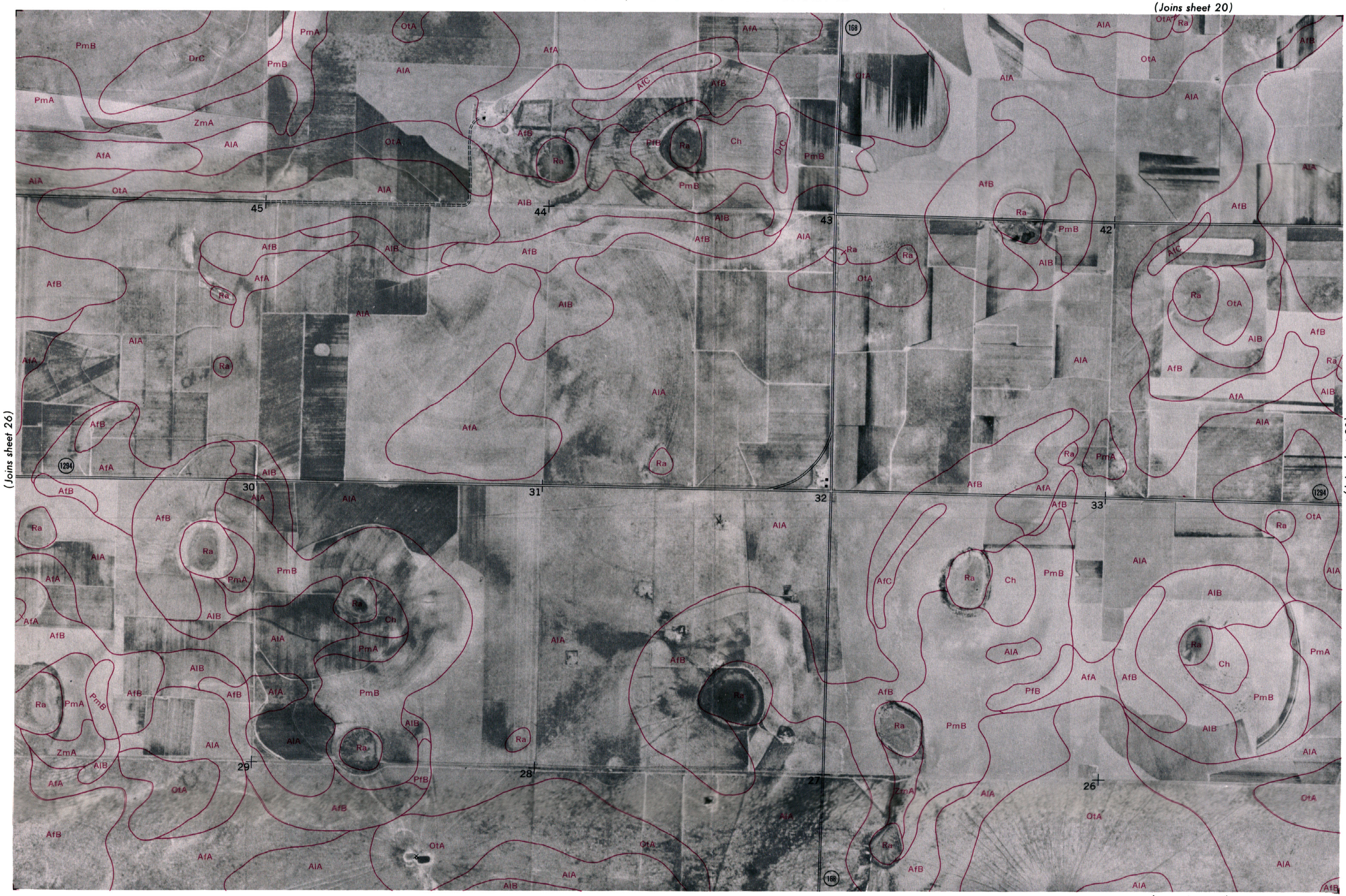
27

(Joins sheet 20)

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Texas Agricultural Experiment Station.

Land division corners and numbers shown on this map are indefinite.

(Joins sheet 26)



(Joins sheet 28)

0 ½ 1 Mile Scale 1:20000 0 5000 Feet

(Joins sheet 34)

28

(Joins sheet 21)

N

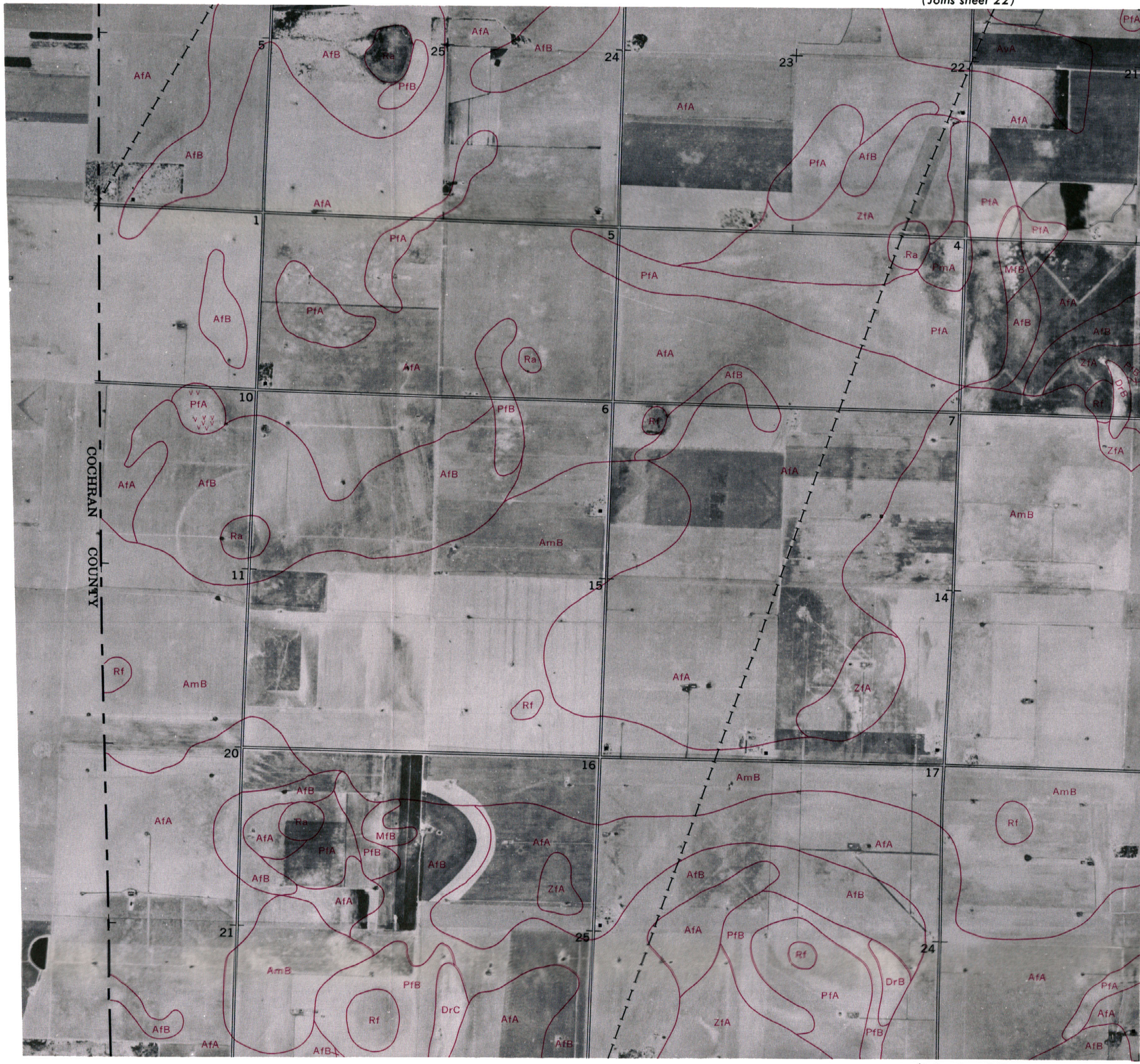
(Joins sheet 27)

(Joins sheet 35)

0 ½ 1 Mile Scale 1:20000 0 5000 Feet

(29)

(Joins sheet 22)



(Joins sheet 30)

(Joins sheet 36)

0 ½ 1 Mile Scale 1:20000 0 5000 Feet

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Texas Agricultural Experiment Station.

Land division corners and numbers shown on this map are indefinite.

HOCKLEY COUNTY, TEXAS — SHEET NUMBER 30

(Joins sheet 23)

N

(Joins sheet 29)

(Joins sheet 31)

(Joins sheet 37)

0 ½ 1 Mile Scale 1:20000 0 5000 Feet

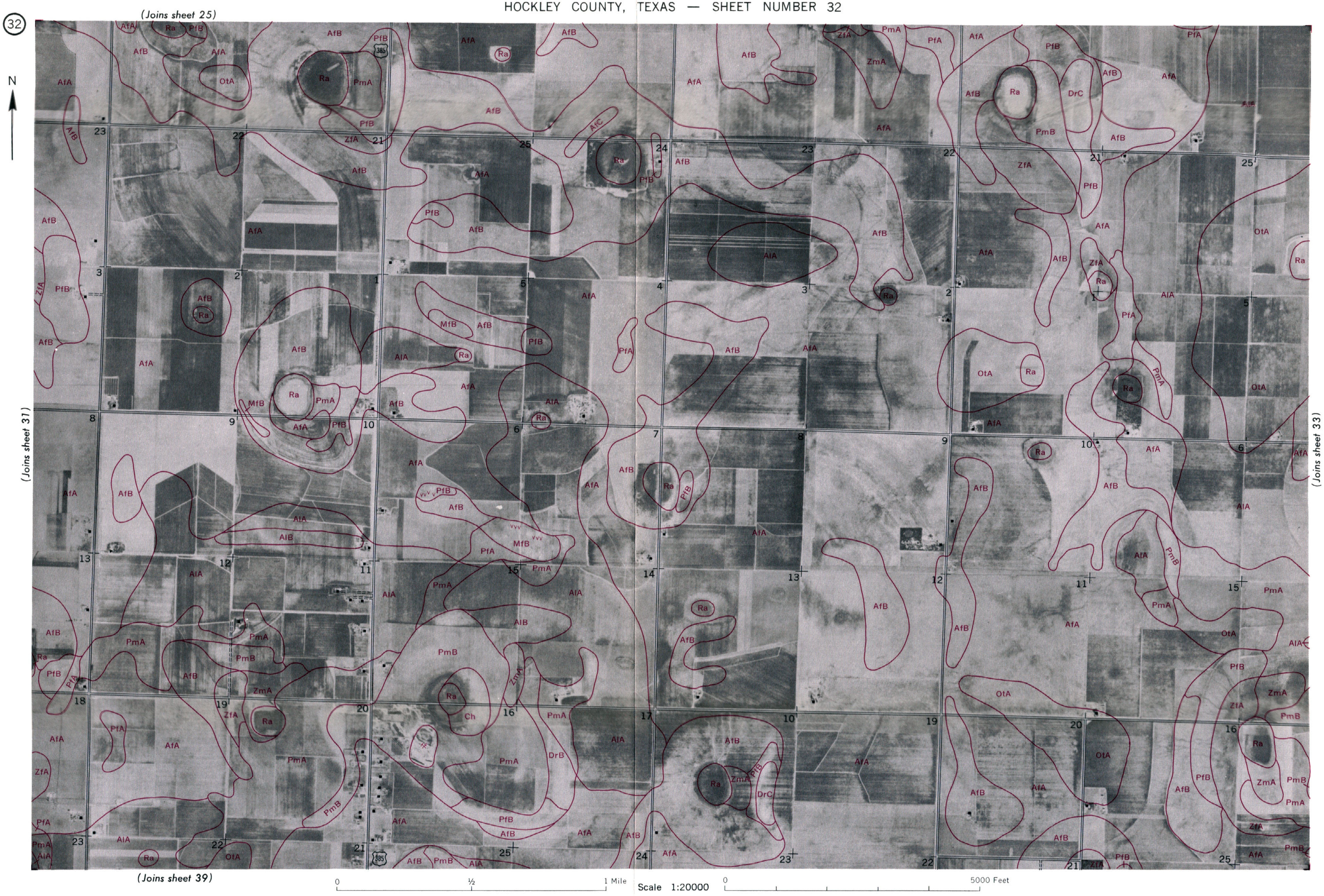
31

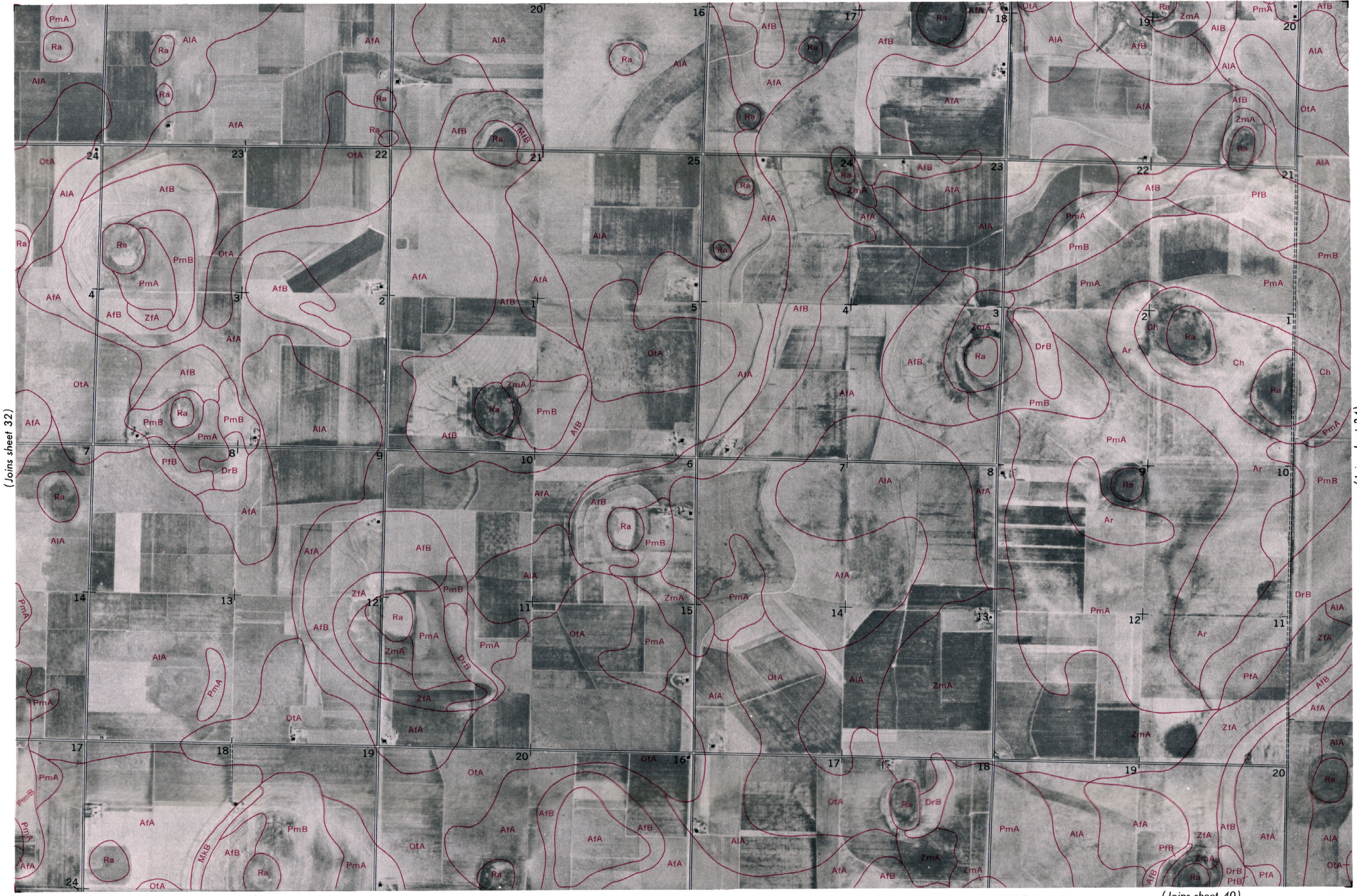
0 ½ 1 Mile Scale 1:20000 0 5000 Feet

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Texas Agricultural Experiment Station.

Land division corners and numbers shown on this map are indefinite.

HOCKLEY COUNTY, TEXAS — SHEET NUMBER 32





0 ½ 1 Mile Scale 1:20000 0 5000 Feet

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Texas Agricultural Experiment Station.

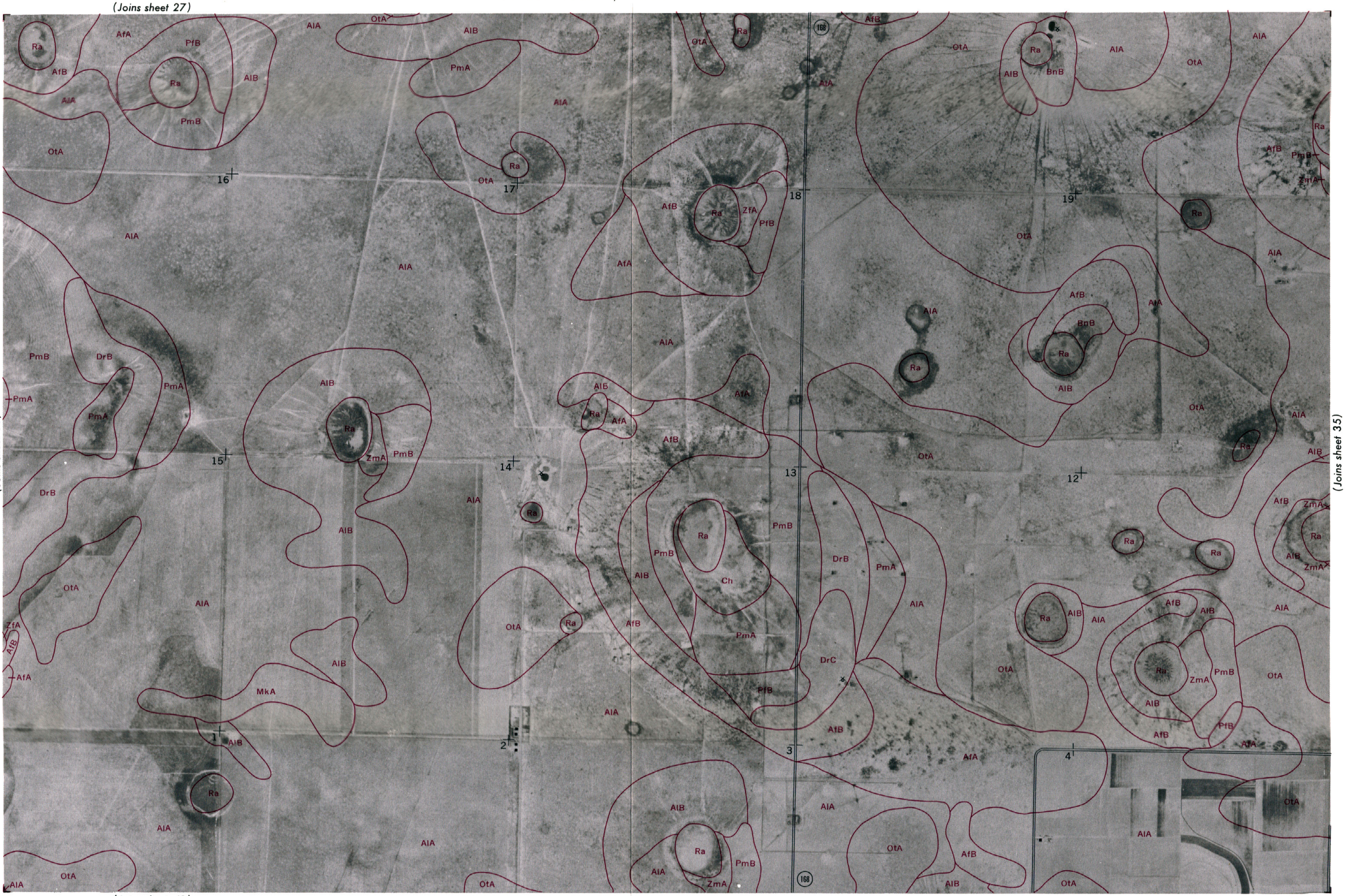
Land division corners and numbers shown on this map are indefinite.

HOCKLEY COUNTY, TEXAS — SHEET NUMBER 34

N

(Joins sheet 27)

(Joins sheet 33)



(Joins sheet 35)

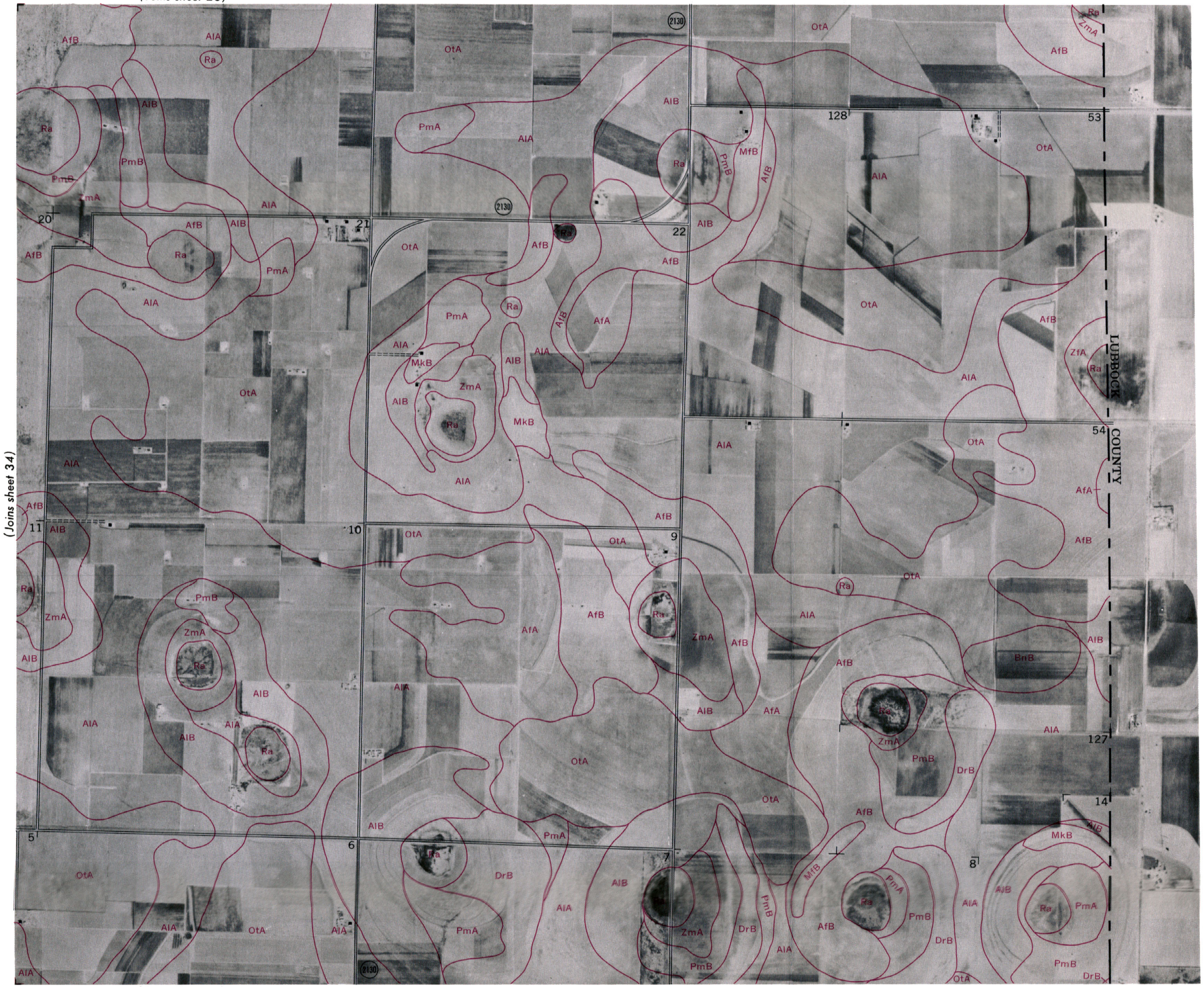
(Joins sheet 41)

0 ½ 1 Mile Scale 1:20000 0 5000 Feet

N

(Joins sheet 28)

(Joins sheet 34)



(Joins sheet 42)

0 ½ 1 Mile Scale 1:20000 0 5000 Feet

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Texas Agricultural Experiment Station.

Land division corners and numbers shown on this map are indefinite.

HOCKLEY COUNTY, TEXAS — SHEET NUMBER 36

N

(Joins sheet 29)

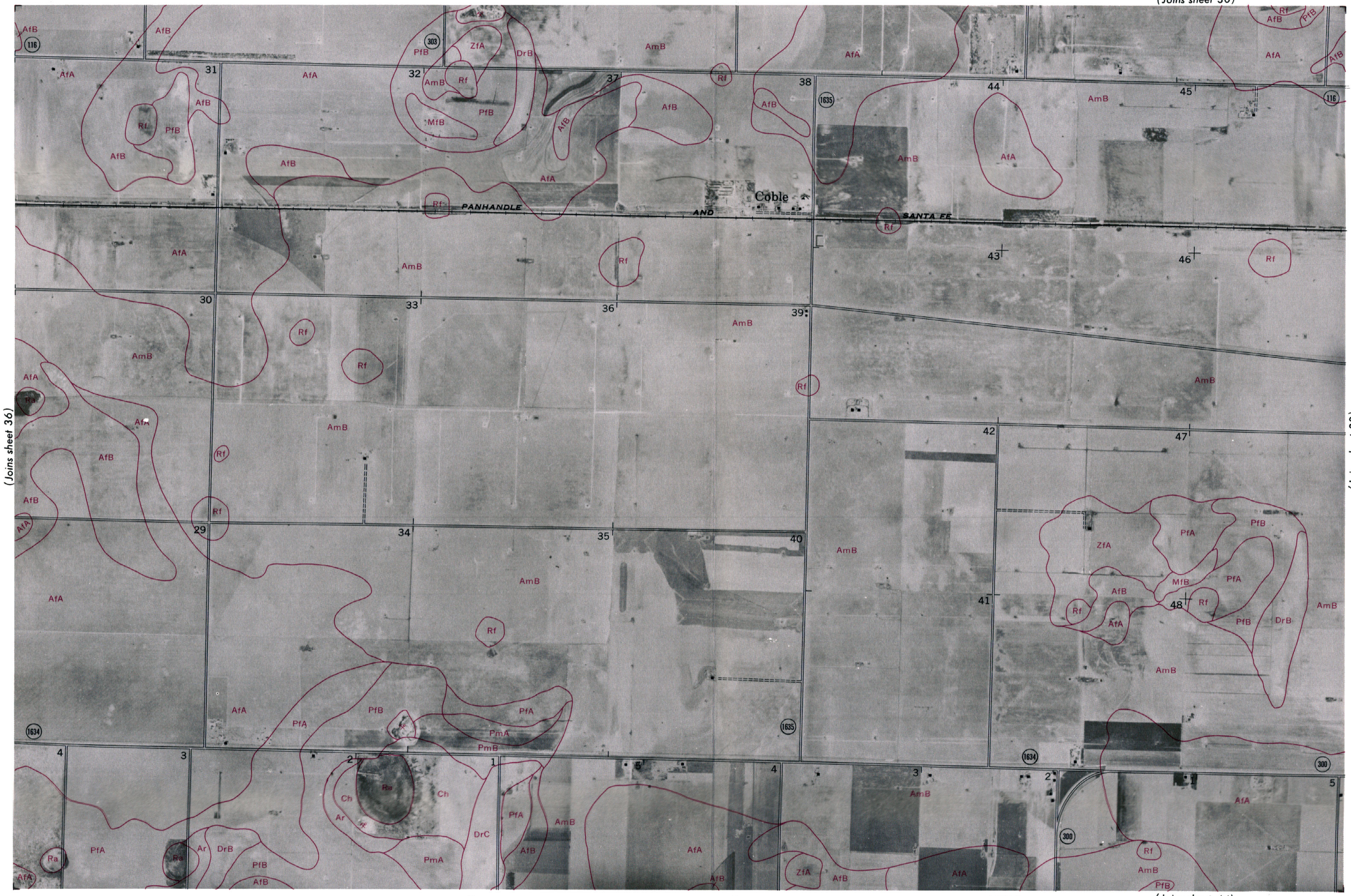
(Joins sheet 37)

(Joins sheet 43)

0 ½ 1 Mile Scale 1:20000 0 5000 Feet

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Texas Agricultural Experiment Station.

Land division corners and numbers shown on this map are indefinite.



0 ½ 1 Mile Scale 1:20000 0 5000 Feet

38

(Joins sheet 31)

(Joins sheet 37)

(Joins sheet 39)

(Joins sheet 45)

0 ½ 1 Mile Scale 1:20000 0 5000 Feet

HOCKLEY COUNTY, TEXAS — SHEET NUMBER 39

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Texas Agricultural Experiment Station.
Land division corners and numbers shown on this map are indefinite

0 ½ 1 Mile
Scale 1:20000
0 5000 Feet

40

(Joins sheet 33)

(Joins sheet 47)

0 ½ 1 Mile Scale 1:20000 0 5000 Feet

(Joins sheet 34)

(Joins sheet 48)

Scale 1:20000

0 ½ 1 Mile

0 5000 Feet

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Texas Agricultural Experiment Station.

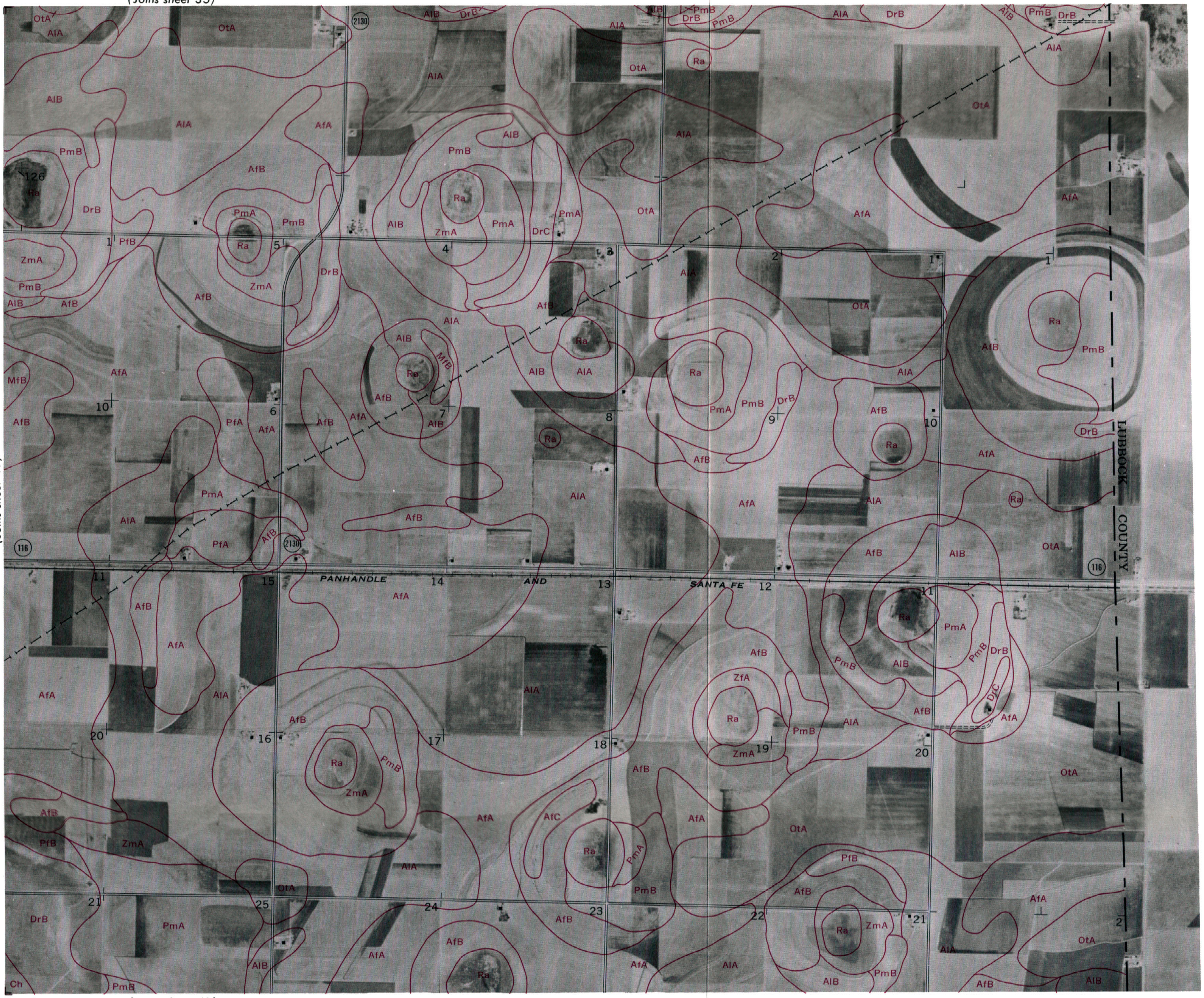
Land division corners and numbers shown on this map are indefinite.

42

N

(Joins sheet 35)

(Joins sheet 41)



(Joins sheet 49)

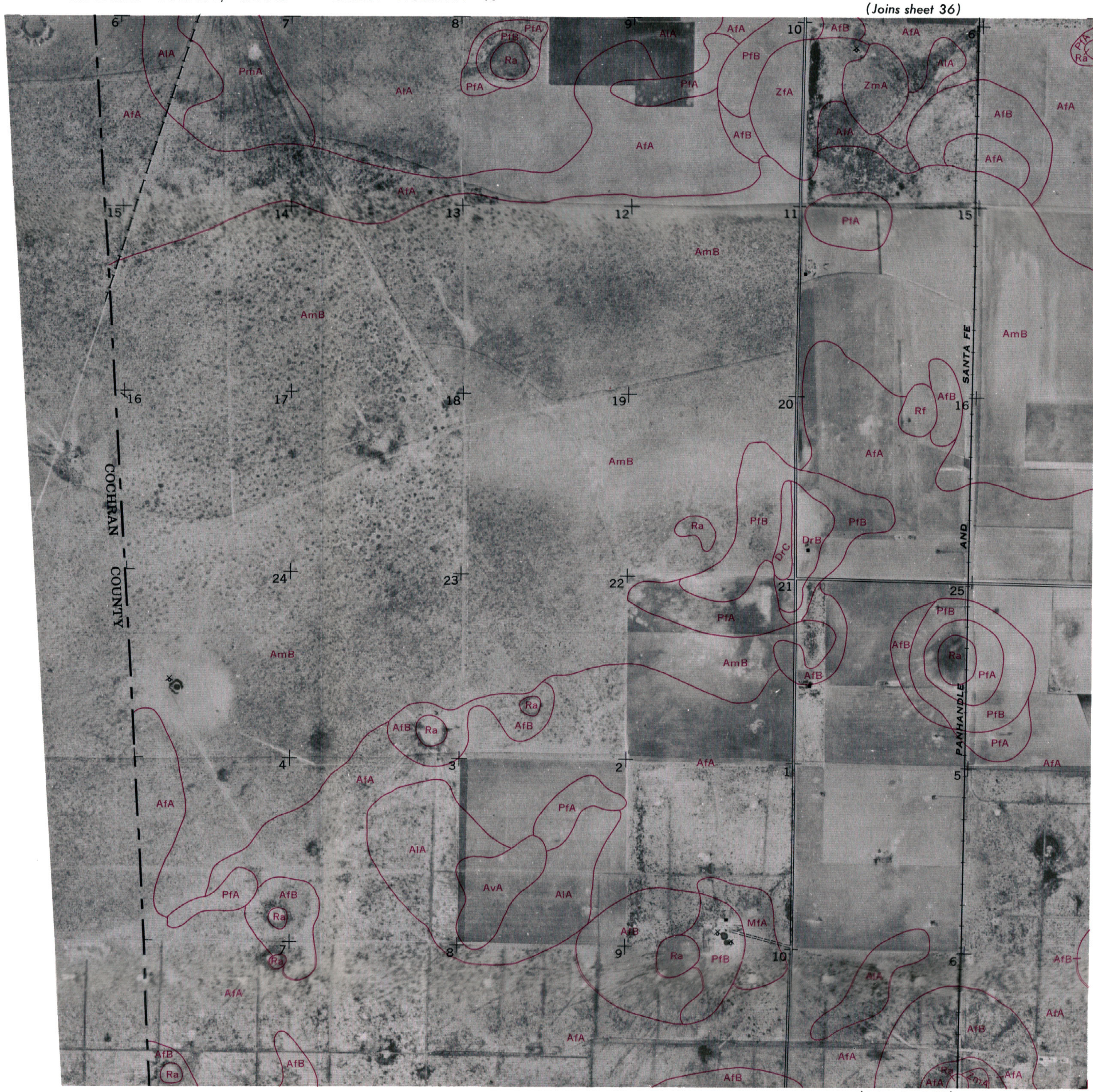
0 ½ 1 Mile

Scale 1:20000

0 5000 Feet

(Joins sheet 36)

43



(Joins sheet 44)

(Joins sheet 50)

0 ½ 1 Mile Scale 1:20000 0 5000 Feet

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Texas Agricultural Experiment Station.

Land division corners and numbers shown on this map are indefinite.

(44)

(Joins sheet 37)

(Joins sheet 43)

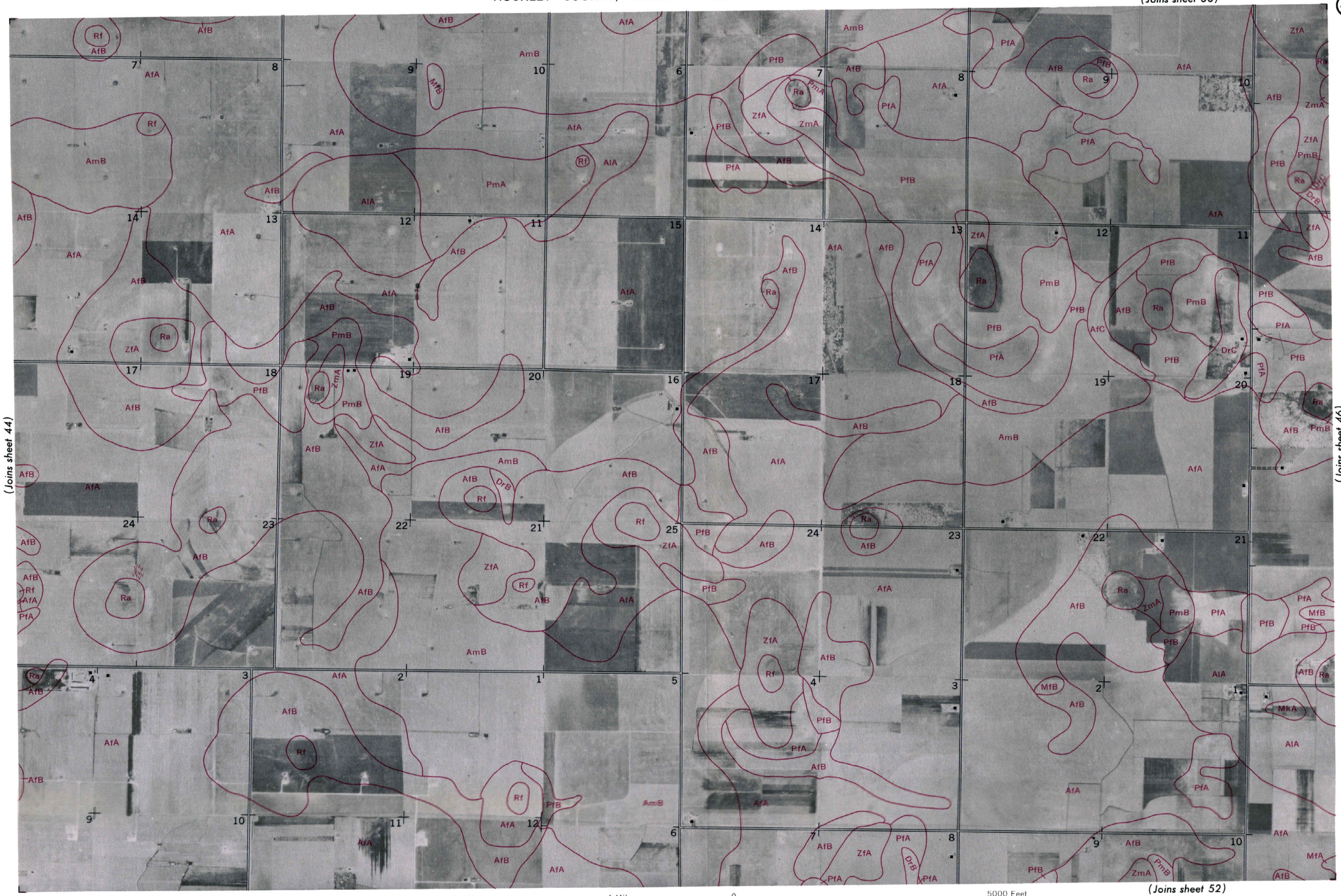
(Joins sheet 45)

(Joins sheet 51)

0 ½ 1 Mile Scale 1:20000 0 5000 Feet

HOCKLEY COUNTY, TEXAS — SHEET NUMBER 45

45



Scale 1:20000

0 ½ 1 Mile

0 5000 Feet

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Texas Agricultural Experiment Station.

Land division corners and numbers shown on this map are indefinite.

46

HOCKLEY COUNTY, TEXAS — SHEET NUMBER 46

(Joins sheet 39)

N

(Joins sheet 45)

(Joins sheet 47)

(Joins sheet 53)

0 ½ 1 Mile

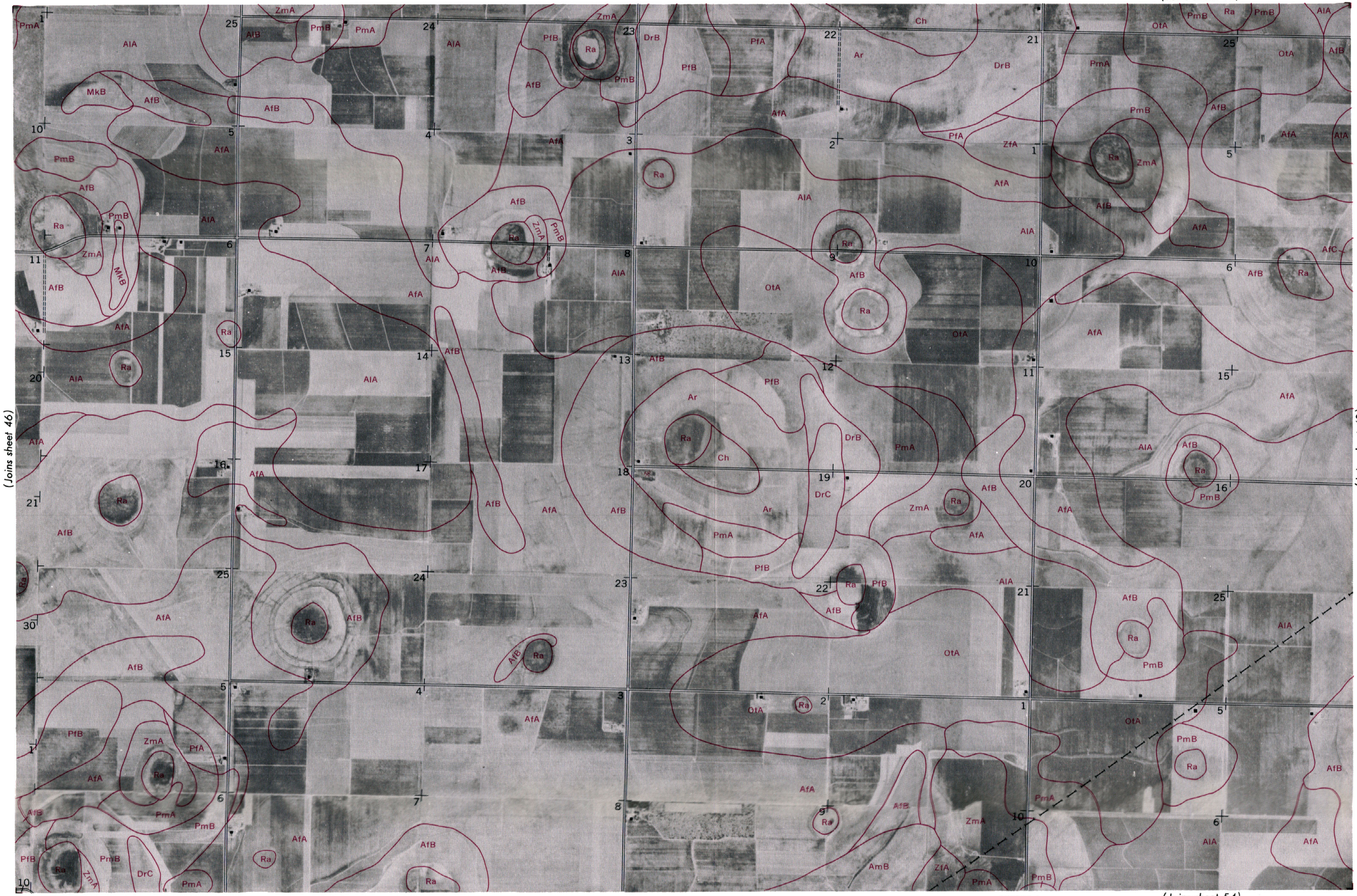
Scale 1:20000

0 5000 Feet

HOCKLEY COUNTY, TEXAS — SHEET NUMBER 47

47

(Joins sheet 40)



(Joins sheet 46)

(Joins sheet 48)

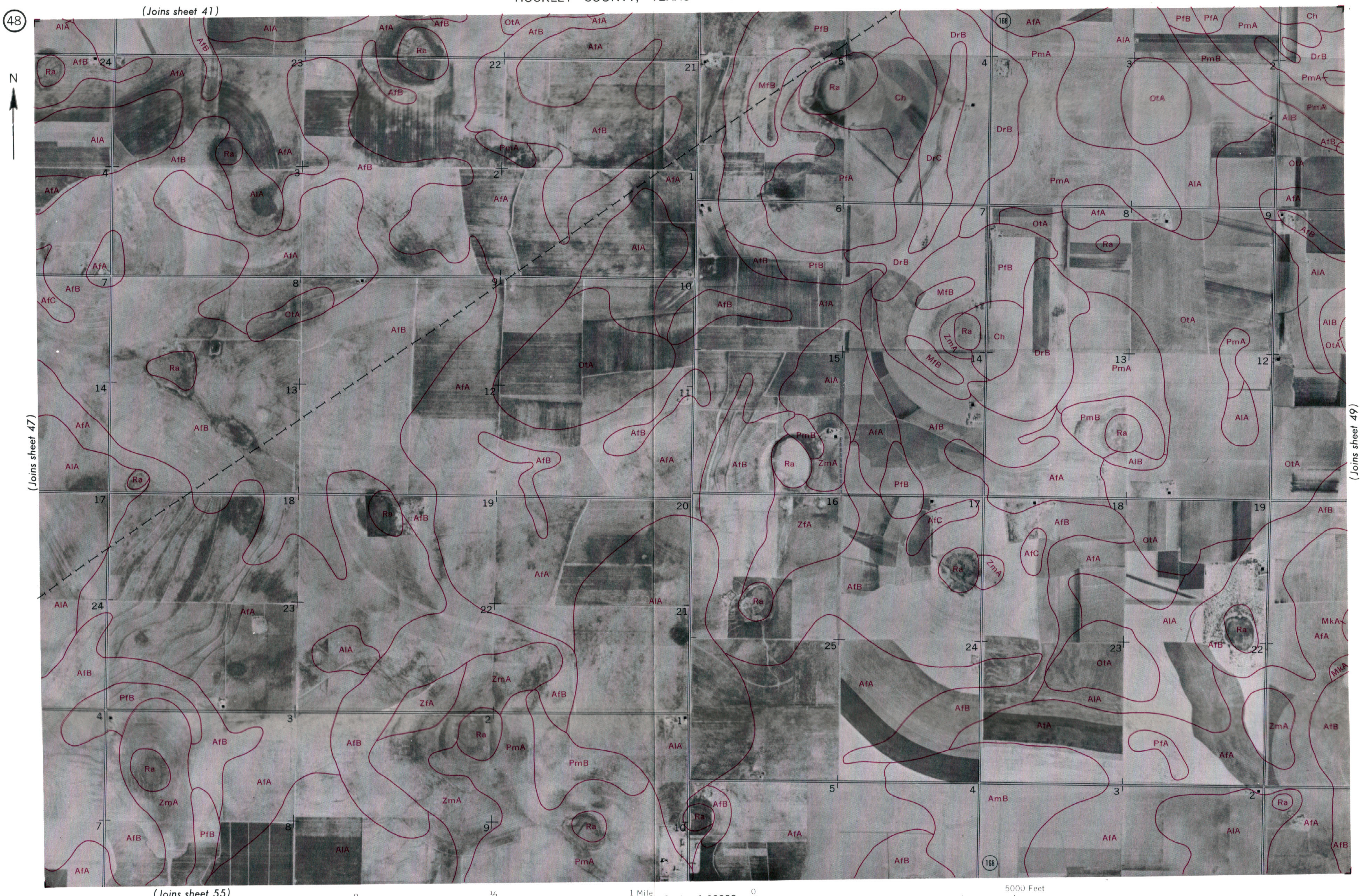
(Joins sheet 54)

0 ½ 1 Mile Scale 1:20000 0 5000 Feet

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Texas Agricultural Experiment Station.

Land division corners and numbers shown on this map are indefinite.

48



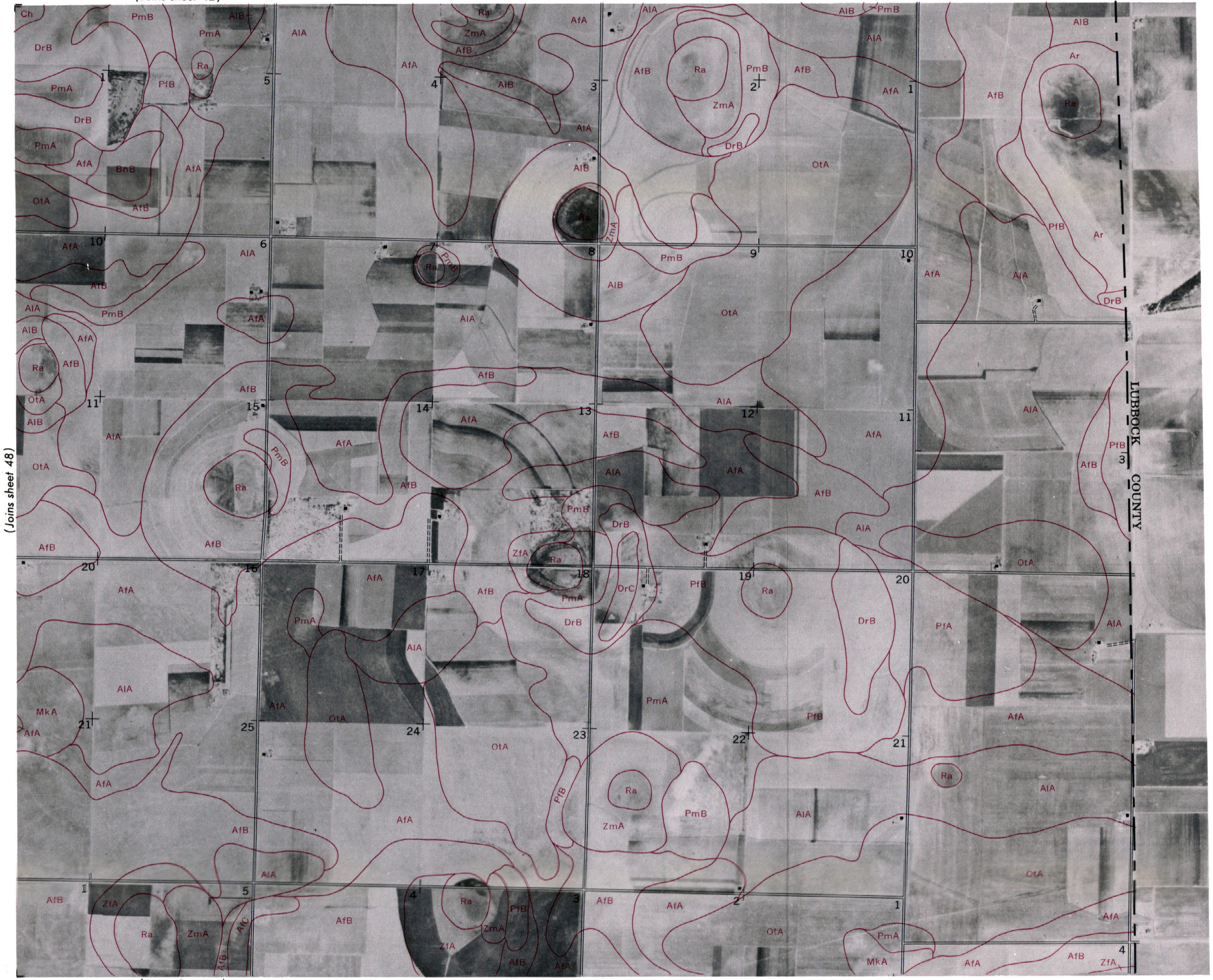
0 ½ 1 Mile

Scale 1:20000

0 5000 Feet

(Joins sheet 42)

(Joins sheet 48)



(Joins sheet 56)

0 ½ 1 Mile Scale 1:20000 0 5000 Feet

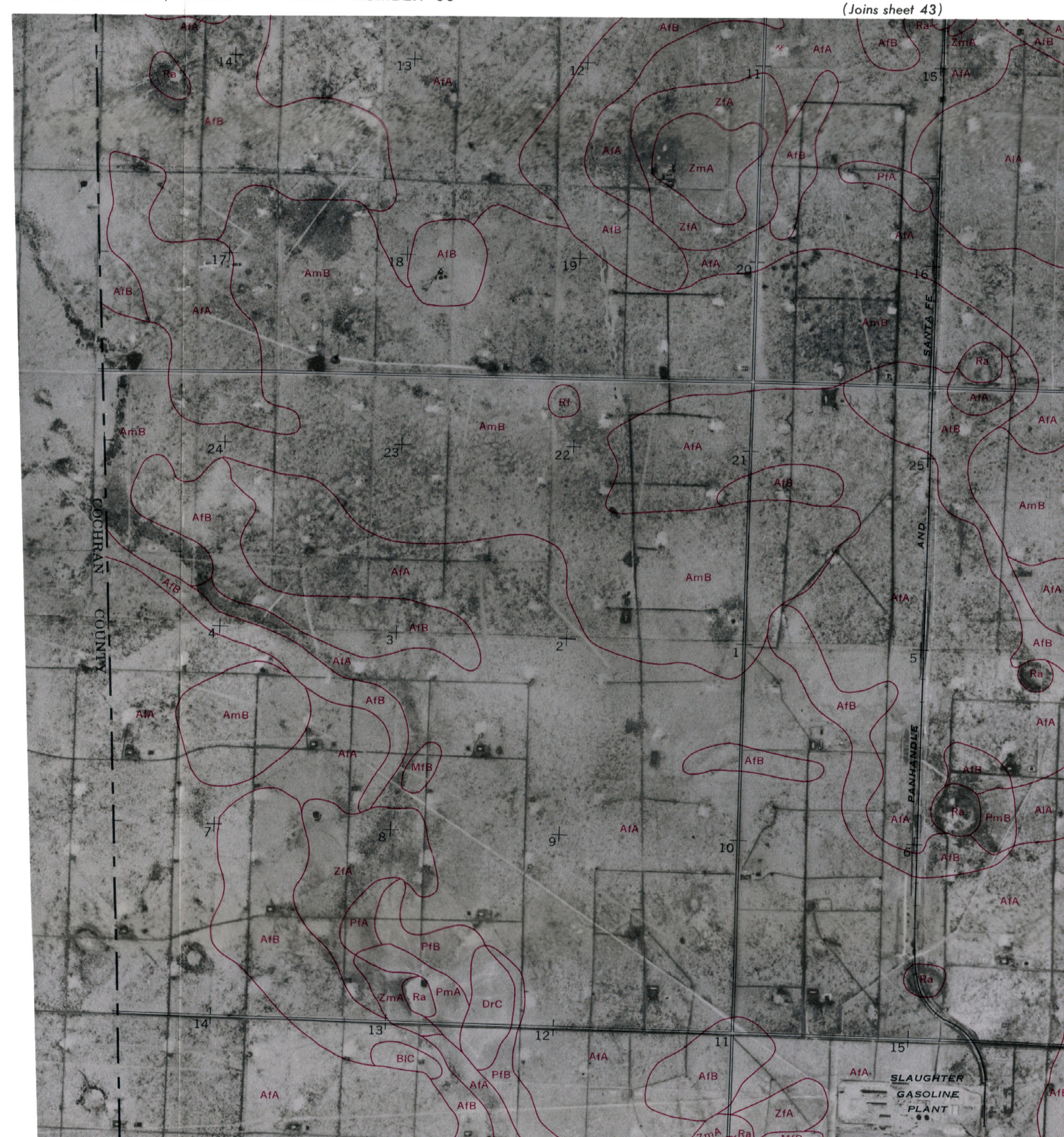
This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Texas Agricultural Experiment Station.

Land division corners and numbers shown on this map are indefinite.

N

HOCKLEY COUNTY, TEXAS — SHEET NUMBER 50

(Joins sheet 43)



(Joins sheet 51)

(Joins sheet 57)

0 ½ 1 Mile Scale 1:20000 0 5000 Feet

HOCKLEY COUNTY, TEXAS — SHEET NUMBER 51

51

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Texas Agricultural Experiment Station.

Land division corners and numbers shown on this map are indefinite.

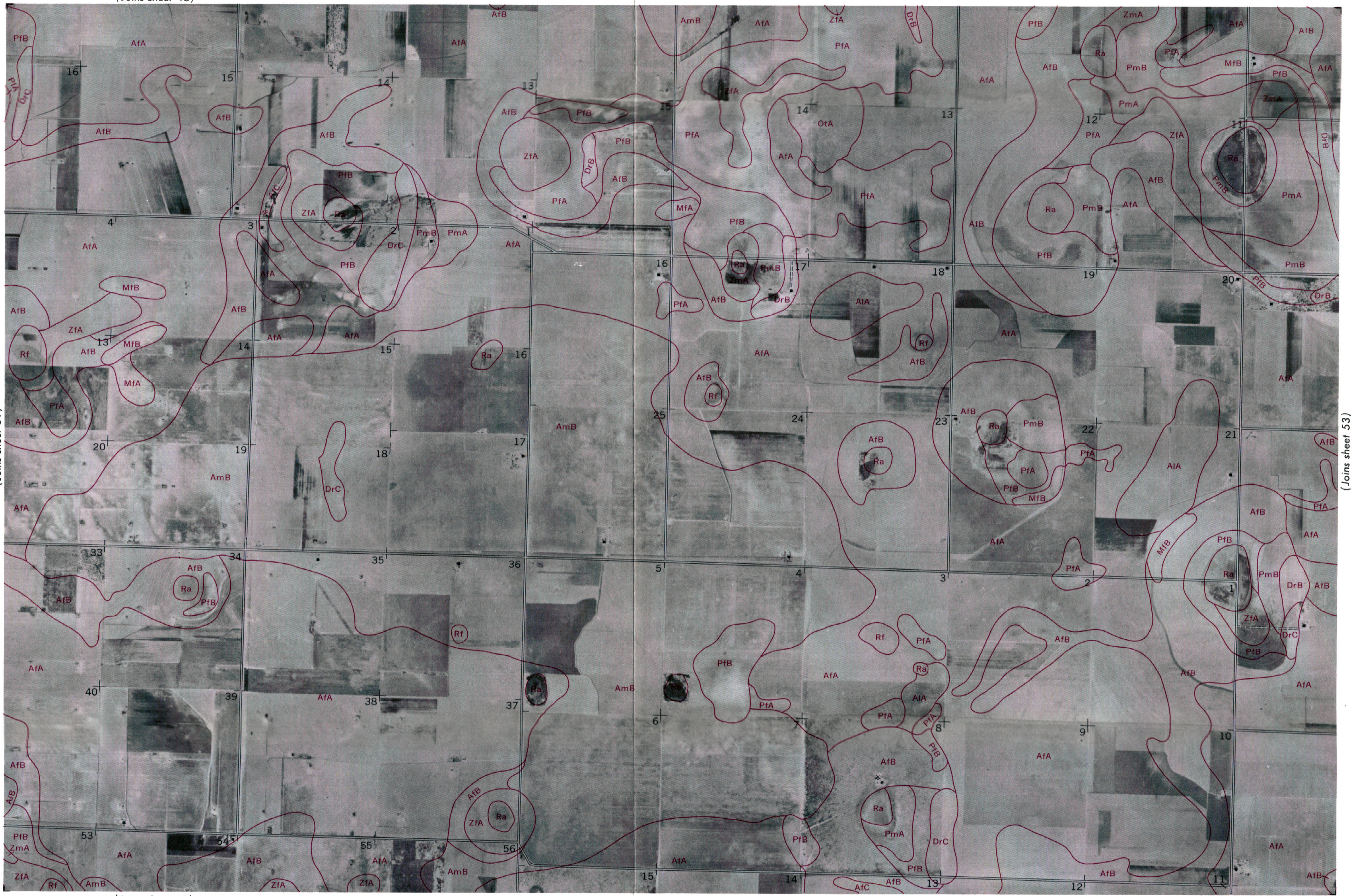
0 ½ 1 Mile Scale 1:20000 0 5000 Feet

52

N

(Joins sheet 45)

(Joins sheet 51)



(Joins sheet 53)

(Joins sheet 59)

0 ½ 1 Mile

Scale 1:20000

0 5000 Feet

HOCKLEY COUNTY, TEXAS — SHEET NUMBER 53

53

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Texas Agricultural Experiment Station.
Land division corners and numbers shown on this map are indefinite.

(Joins sheet 46)

(Joins sheet 60)

0 ½ 1 Mile

Scale 1:20000

0 5000 Feet

HOCKLEY COUNTY, TEXAS — SHEET NUMBER 54

N

(Joins sheet 47)

(Joins sheet 53)

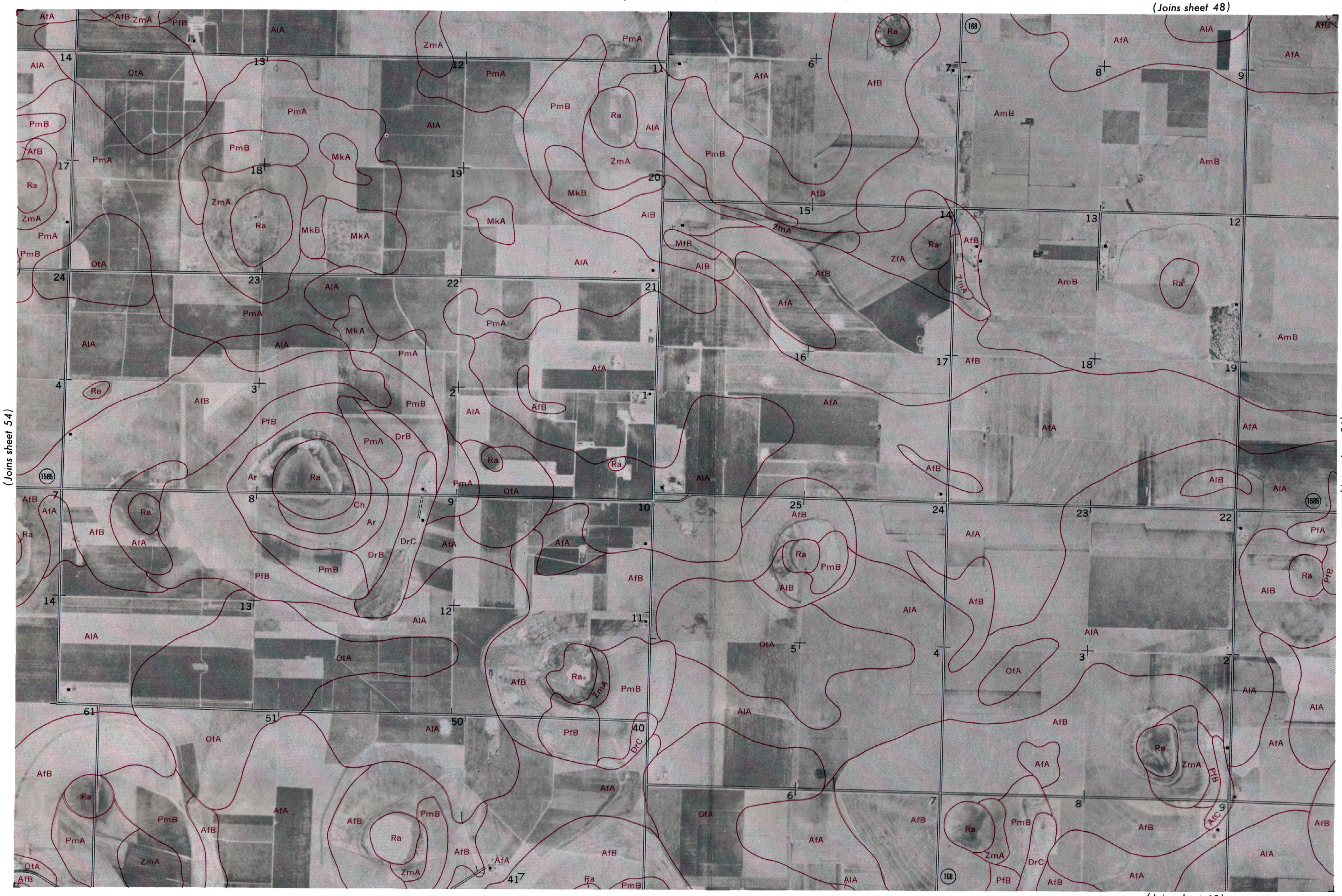
(Joins sheet 55)

(Joins sheet 61)

0 ½ 1 Mile

Scale 1:20000

0 5000 Feet



0 ½ 1 Mile Scale 1:20000 0 5000 Feet

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Texas Agricultural Experiment Station.

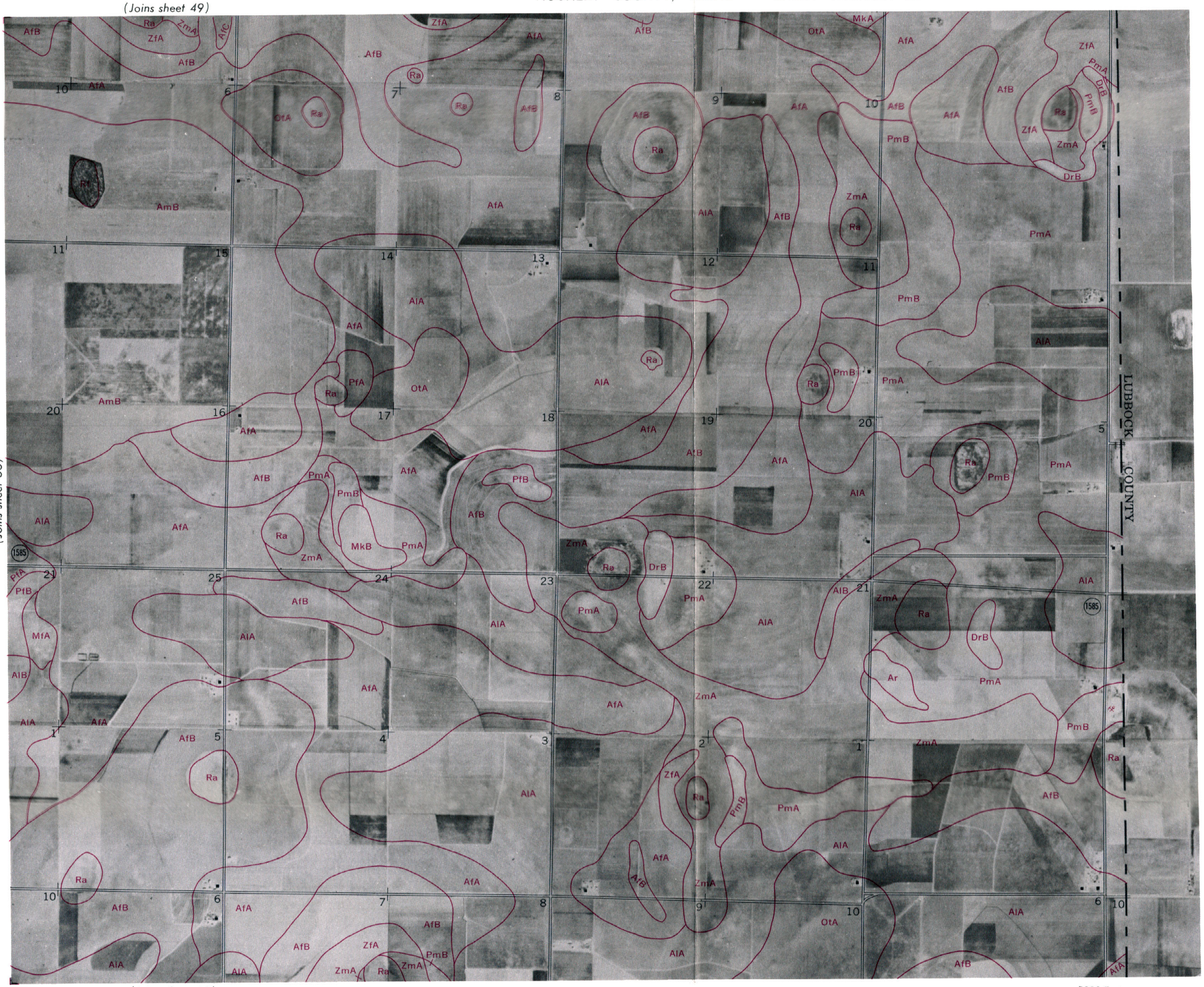
Land division corners and numbers shown on this map are indefinite.

56

(Joins sheet 49)

N

(Joins sheet 55)



(Joins sheet 63)

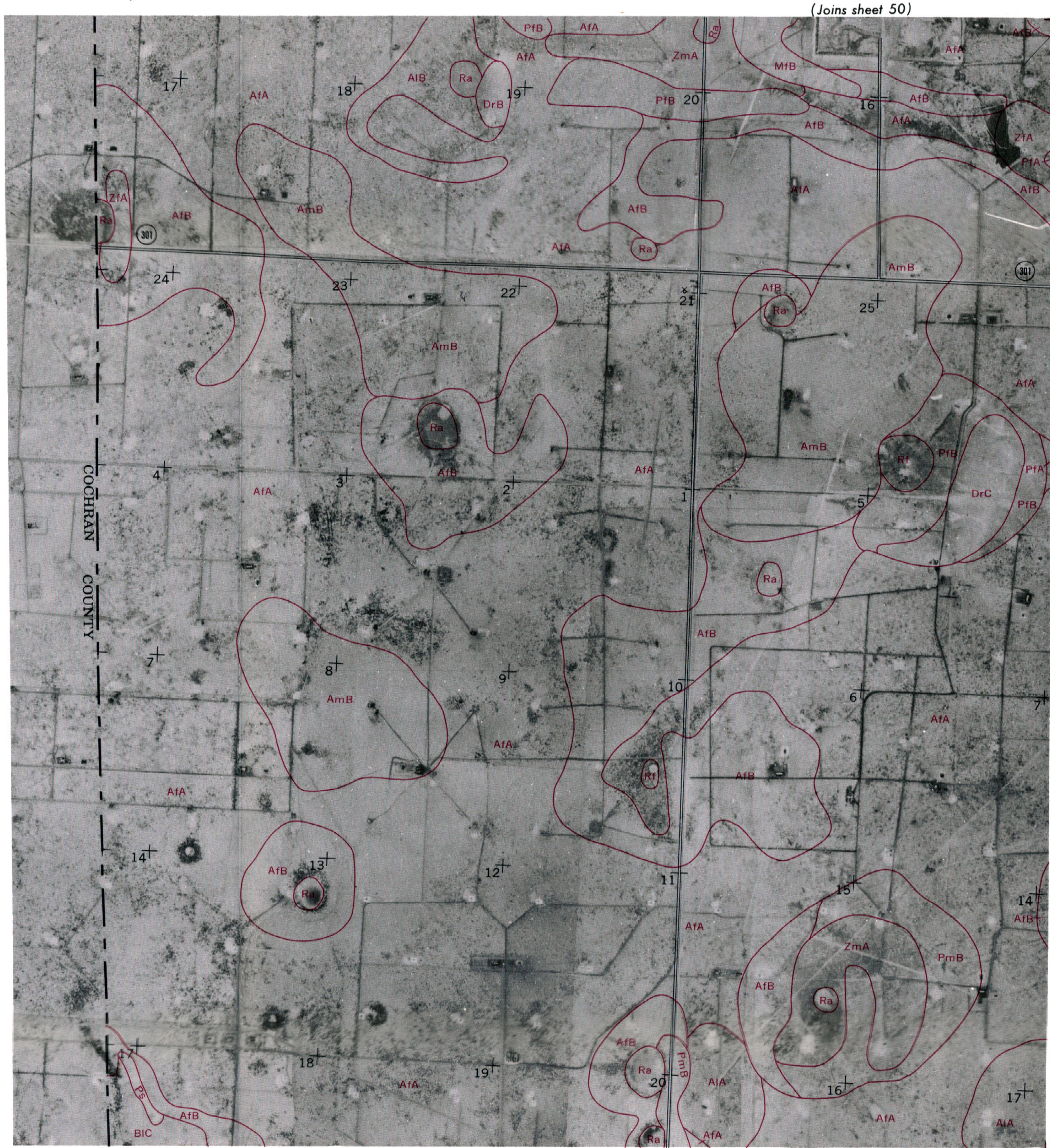
0 ½ 1 Mile

Scale 1:20000

0 5000 Feet

(Joins sheet 50)

57



(Joins sheet 58)

(Joins sheet 64)

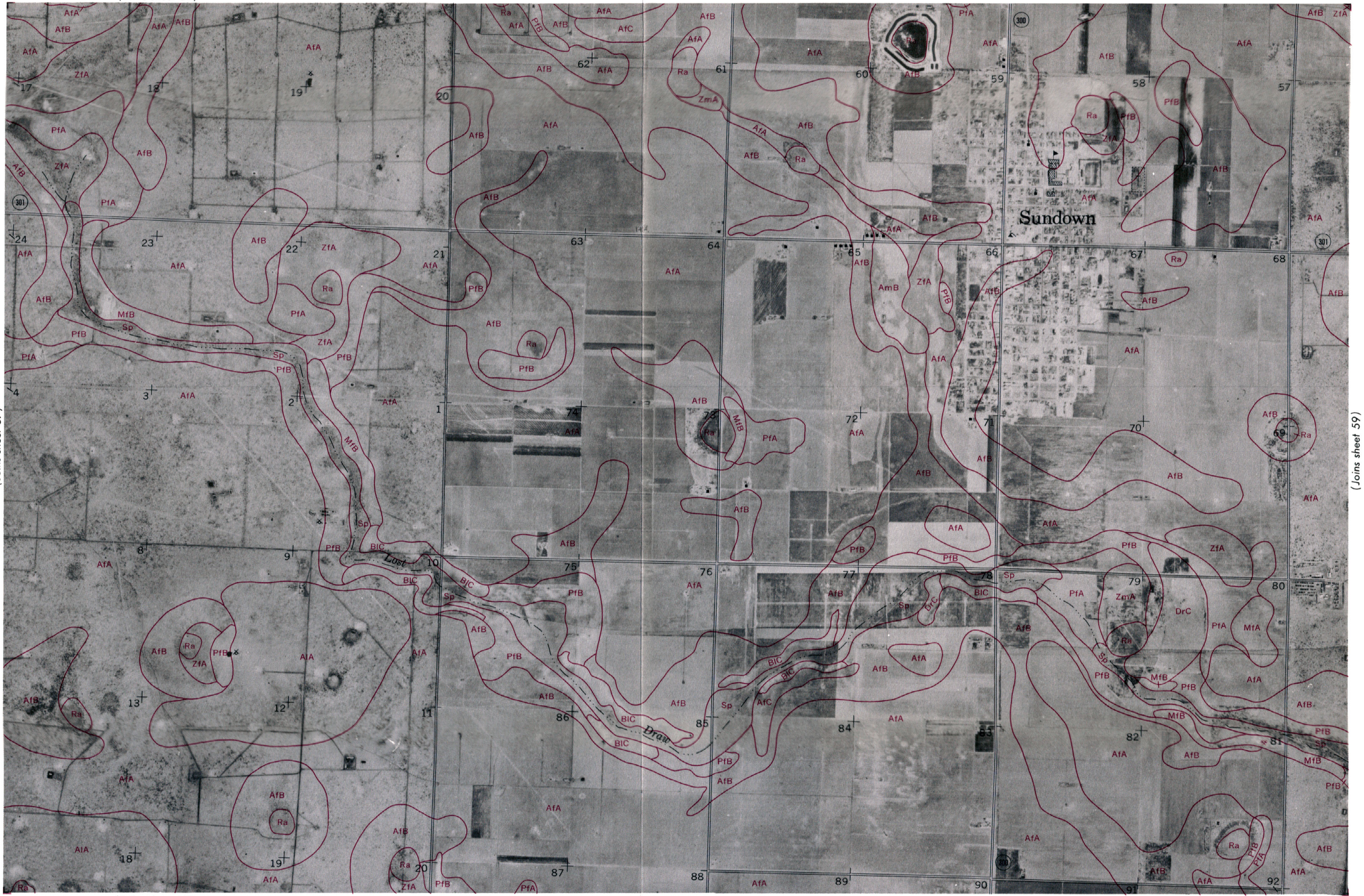
0 ½ 1 Mile Scale 1:20000 0 5000 Feet

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Texas Agricultural Experiment Station.

Land division corners and numbers shown on this map are indefinite.

(Joins sheet 51)

(Joins sheet 57)



(Joins sheet 59)

(Joins sheet 65)

0 ½ 1 Mile

Scale 1:20000

0 5000 Feet

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Texas Agricultural Experiment Station.

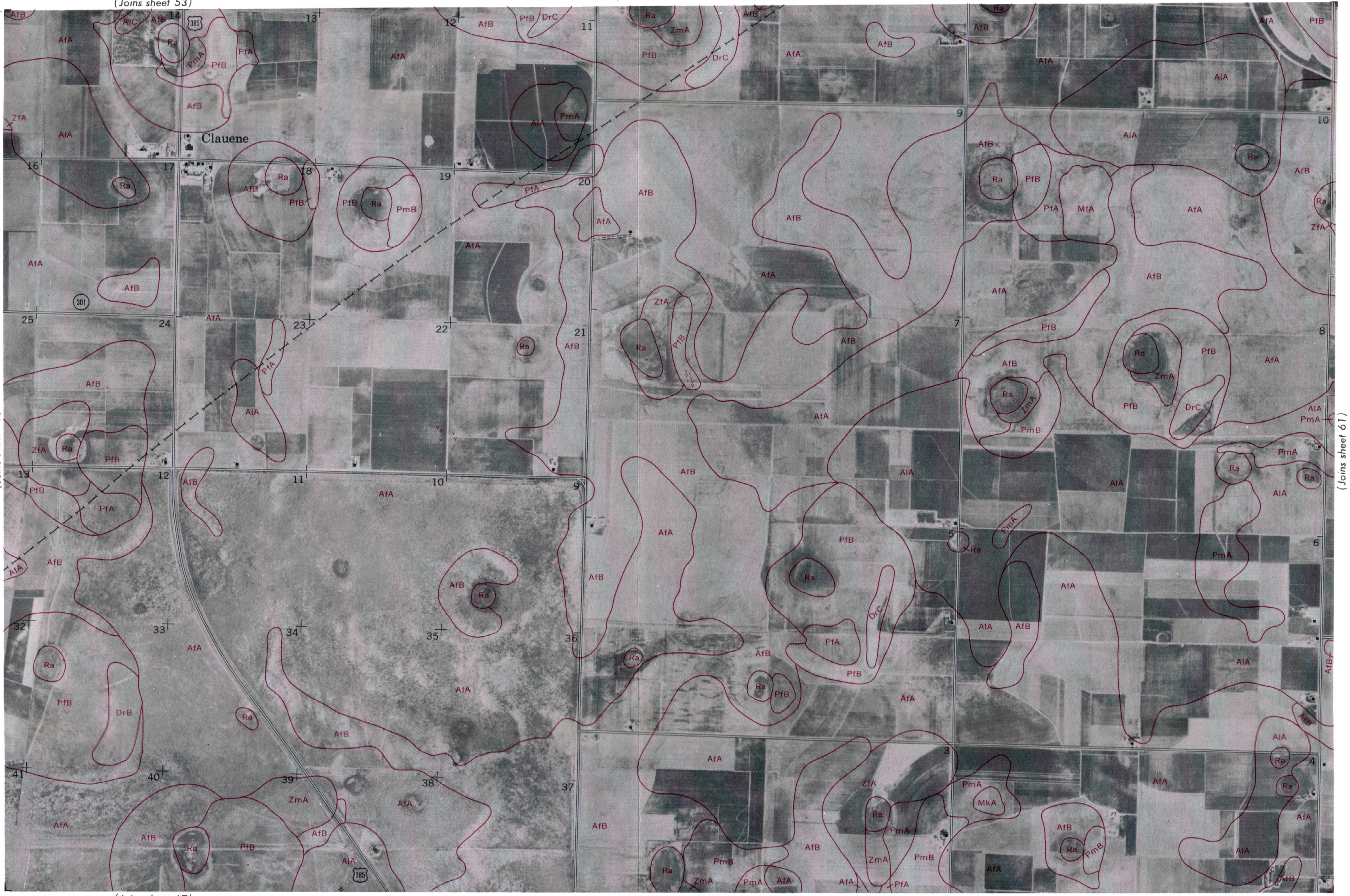
Land division corners and numbers shown on this map are indefinite.

0 ½ 1 Mile Scale 1:20000 0 5000 Feet

HOCKLEY COUNTY, TEXAS — SHEET NUMBER 60

(Joins sheet 53)

(Joins sheet 59)



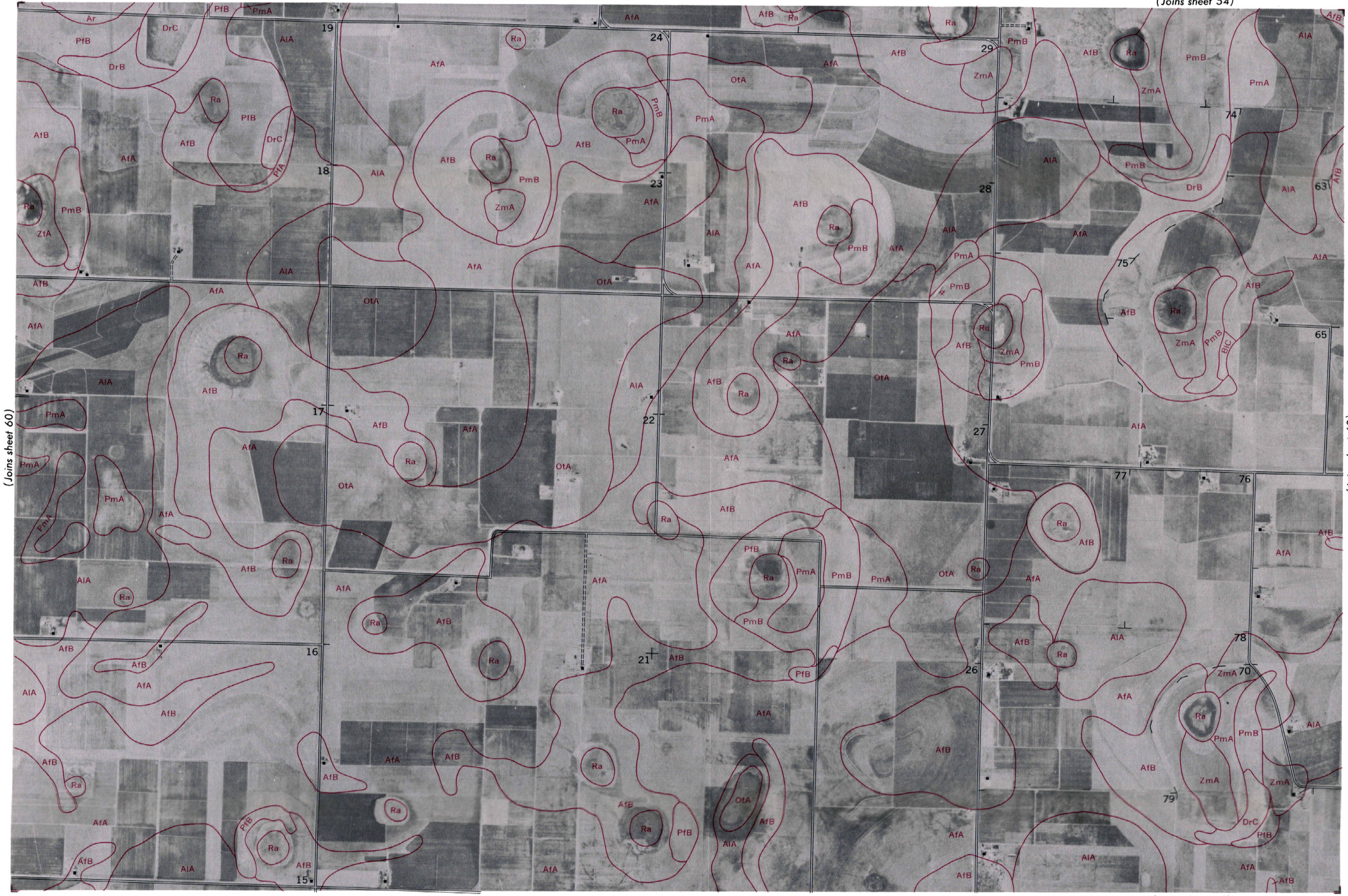
(Joins sheet 61)

(Joins sheet 67)

0 ½ 1 Mile

Scale 1:20000

0 5000 Feet



0 ½ 1 Mile Scale 1:20000 0 5000 Feet

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Texas Agricultural Experiment Station.

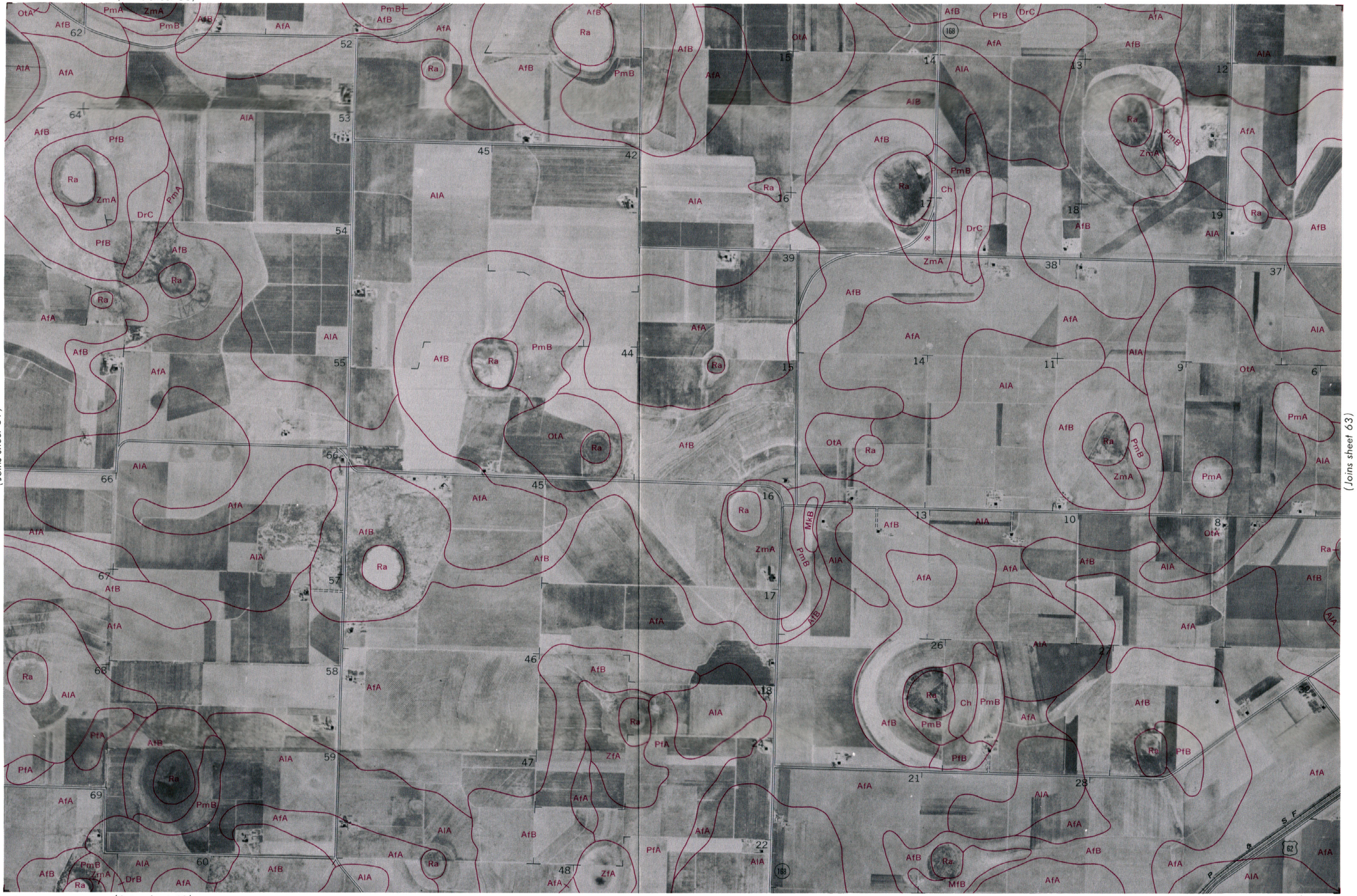
Land division corners and numbers shown on this map are indefinite

62

(Joins sheet 55)

N

(Joins sheet 61)



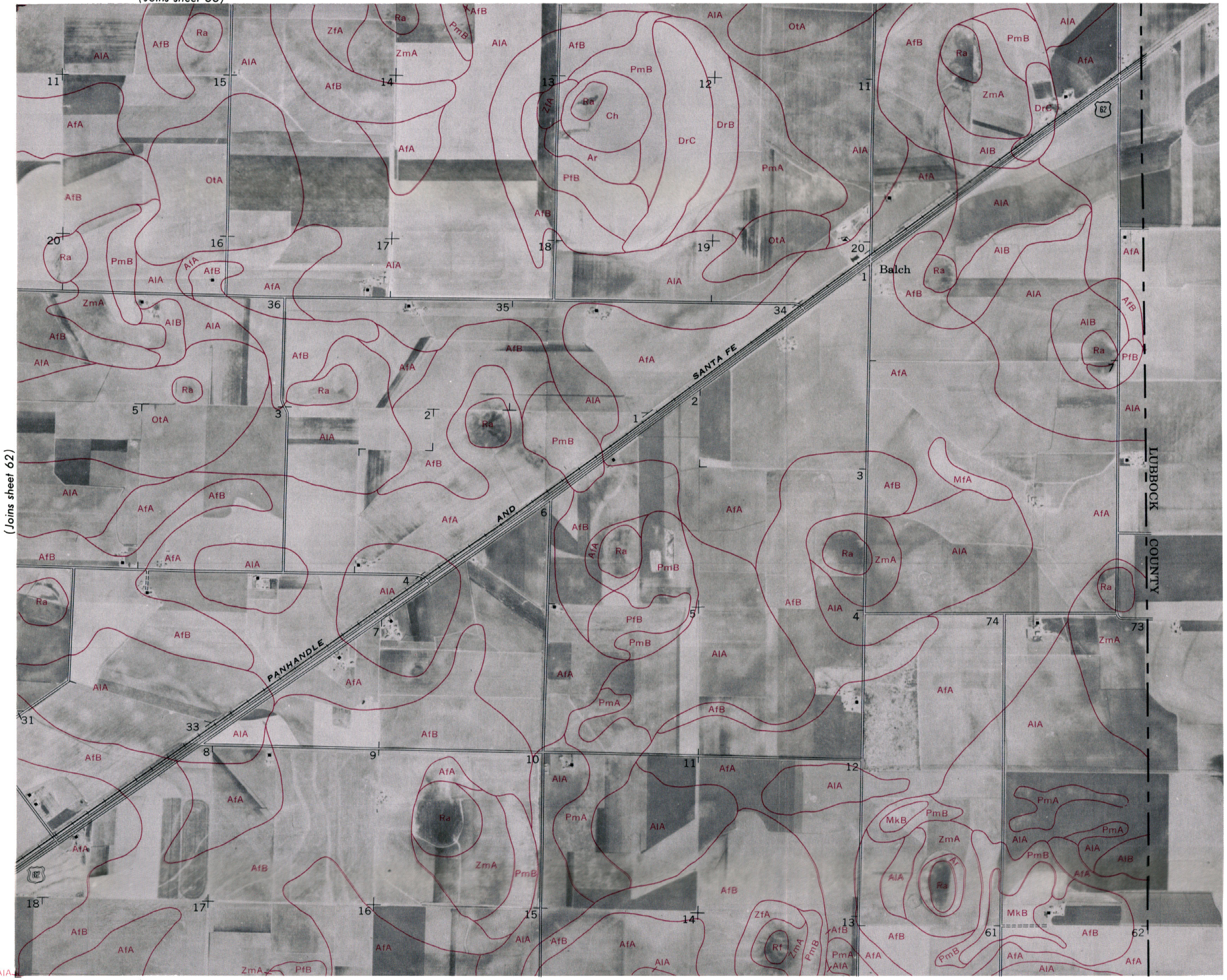
(Joins sheet 63)

(Joins sheet 69)

0 ½ 1 Mile Scale 1:20000 0 5000 Feet

(Joins sheet 56)

(Joins sheet 62)



(Joins sheet 70)

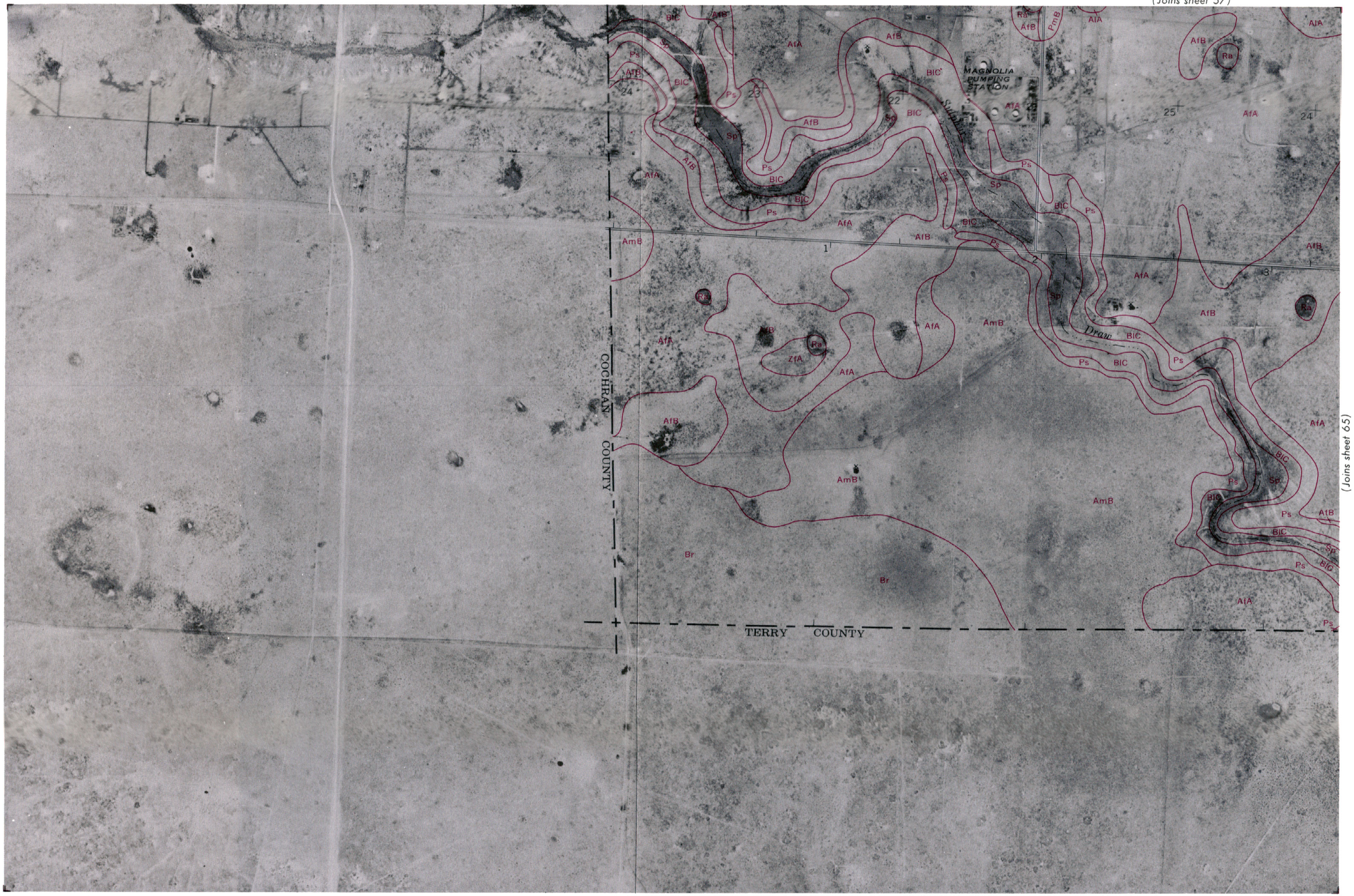
0 ½ 1 Mile Scale 1:20000 0 5000 Feet

N

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Texas Agricultural Experiment Station.

Land division corners and numbers shown on this map are indefinite

(Joins sheet 57)

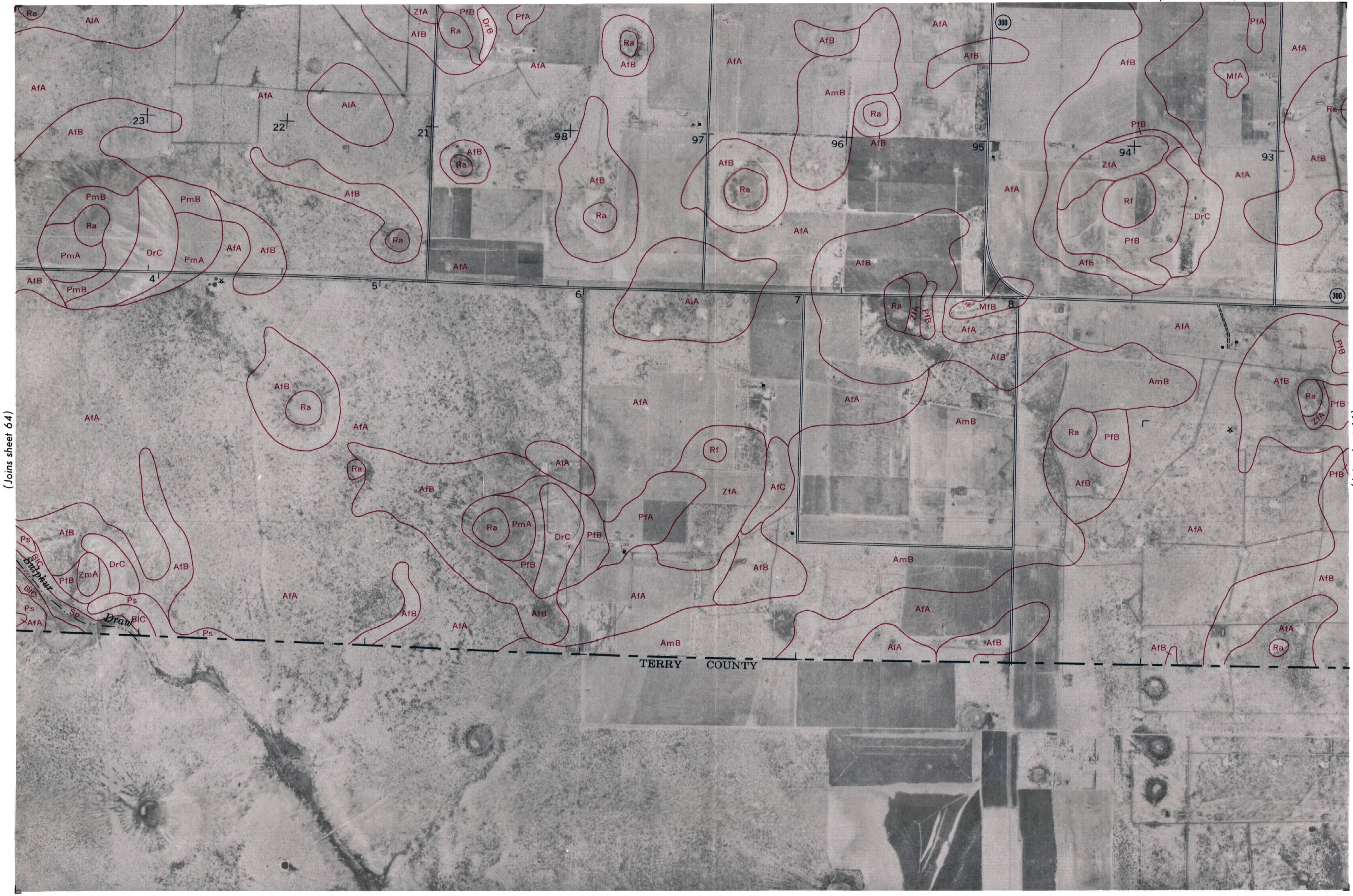


(Joins sheet 65)

0 ½ 1 Mile Scale 1:20000 0 5000 Feet

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Texas Agricultural Experiment Station.

Land division corners and numbers shown on this map are indefinite.



0 ½ 1 Mile Scale 1:20000 0 5000 Feet


66
(Joins sheet 59)
(Joins sheet 65)
(Joins sheet 67)
N
SLAUGHTER
PUMPING
STATION
Lost
Draw
TERRY COUNTY
Scale 1:20000
0
½
1 Mile
0
5000 Feet

(Joins sheet 60)

67

(Joins sheet 66)

(Joins sheet 68)

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Texas Agricultural Experiment Station.
Land division corners and numbers shown on this map are indefinite.

0 ½ 1 Mile Scale 1:20000 0 5000 Feet

(Joins sheet 61)

0 ½ 1 Mile Scale 1:20000 0 5000 Feet

(Joins sheet 62)

N

(Joins sheet 68)

(Joins sheet 70)

0 ½ 1 Mile Scale 1:20000 0 5000 Feet

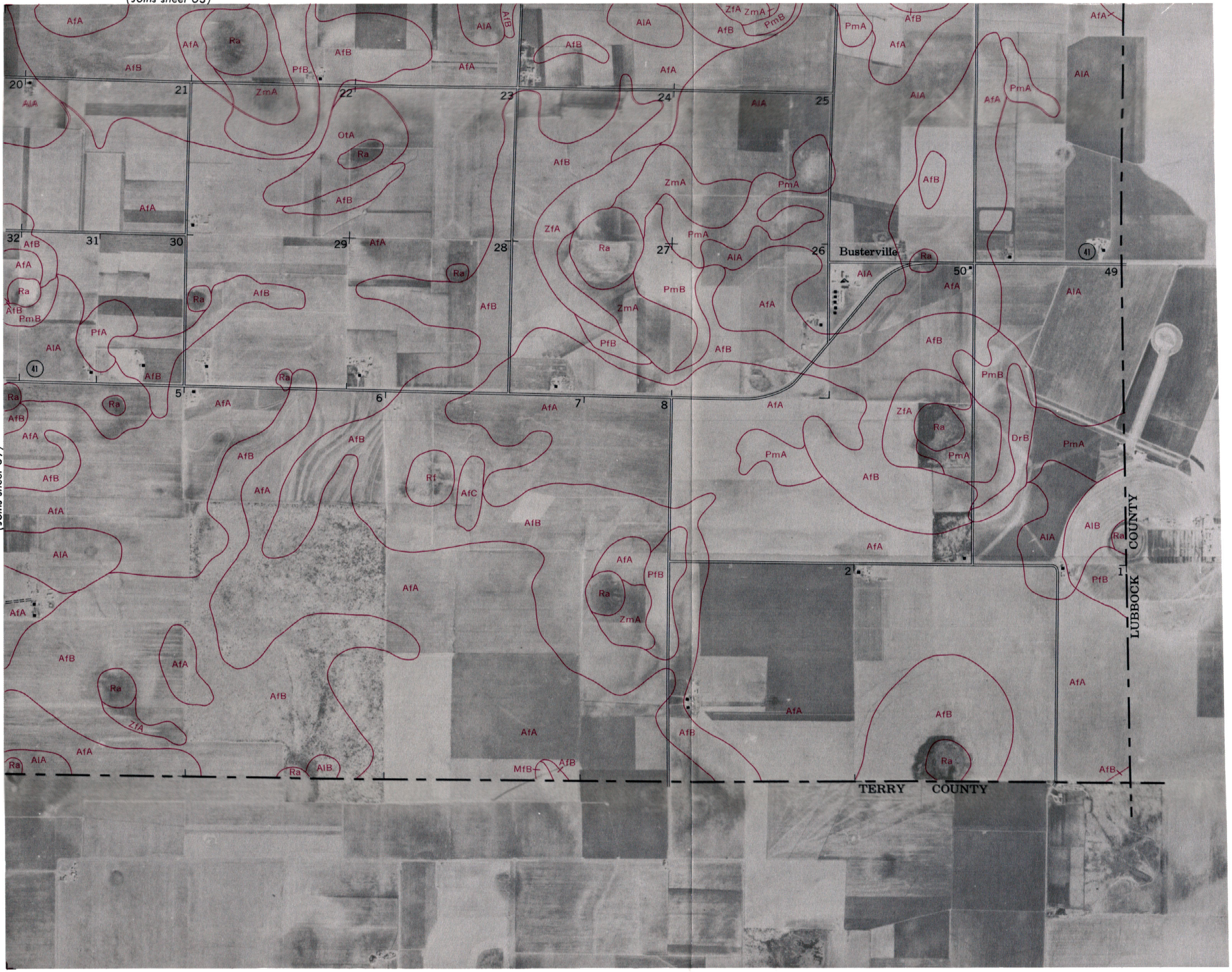
This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Texas Agricultural Experiment Station.

Land division corners and numbers shown on this map are indefinite.

70

(Joins sheet 63)

(Joins sheet 69)



0 ½ 1 Mile Scale 1:20000 0 5000 Feet